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Relevance of Red Book Information to the Directorate of Engineering and Housing Decisionmaking Process

by
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Alan Moore

The Office of the Chief of Engineers (OCE) has for many years produced a document known as the Facilities Engineering Annual Summary of Operations, or the "Red Book." Although the Red Book is widely distributed, it is not clear if the current format and content effectively meet the information needs of real property managers.

The objective of this study was to identify the usefulness of data reported in the Red Book. A survey and a set of interviews identified the information needed to support decisionmaking. The potential uses of the Red Book data were also investigated.

Real property managers need a global and long-term information source like the Red Book. However, managers lack the time and tools necessary to analyze the raw data. It is recommended that OCE continue to publish and distribute the Red Book while providing the incentives and tools to use it. It is also recommended that organizations conduct a rigorous analysis of the decisionmaking problems of real property managers and work with Major Commands and OCE to develop standard unit costs and goals for functional and physical conditions of facilities. The Red Book should also contain analysis of individual installations' trends.

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FOREWORD

This work was performed for the Office of the Chief of Engineers (OCE) under an Operations and Maintenance, Army (OMA) Funding Acquisition Document (FAD) 86-080017, dated January 1986. The OCE Technical Monitor was Mr. Richard Nelson, DAEN-ZCP-B.

The work was conducted by the Facility Systems Division (FS) of the U.S. Army Construction Engineering Research Laboratory (USACERL). Dr. Coskunoglu is an Associate Professor in the College of Engineering, University of Illinois at Urbana-Champaign. Dr. Leblebici is an Associate Professor in the College of Business Administration, University of Illinois. Dr. Michael J. O'Connor is Chief, USACERL-FS. The technical editor was Gloria J. Wienke, USACERL Information Management Office.

COL Everett R. Thomas is Commander and Director of USACERL, and Dr. L. R. Shaffer is Technical Director.

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RELEVANCE OF RED BOOK INFORMATION TO THE DIRECTORATE OF ENGINEERING AND HOUSING DECISIONMAKING PROCESS

1 INTRODUCTION

Background

The Office of the Chief of Engineers (OCE) has for many years produced a document known as the Facilities Engineering Annual Summary of Operations, or the "Red Book." This document is based on the information reported in the Technical Data Reports, and contains each Army installation's annual expenditures for J--Operations of Utilities, K--Maintenance and Repair, L--Minor Construction, and M--Other Engineering Support accounts. About 1,000 copies of the Red Book are distributed annually to commanders and staff officers at Headquarters, Department of the Army (HQDA), and Major Commands (MACOMs), and to installation Directorates of Engineering and Housing (DEHs), as well as those civilian agencies doing contract work for the Army. However, it is not clear if the current format and content of the Red Book effectively meet the information needs of these real property managers. OCE tasked the U.S. Army Construction Engineering Research Laboratory (USACERL) to conduct a comprehensive evaluation of the Red Book and its use.

Objective

The primary purpose of this study is to identify the usefulness of data reported in the Red Book for installation DEHs and MACOMs. More specifically the objectives are to:

1. Identify the annual expenditure-related information requirements of the installations and MACOMs,

2. Analyze the suitability of the Red Book's data for these requirements,

3. Show how certain analyses of the Red Book data can be useful for decisionmakers at different levels of the Army, and

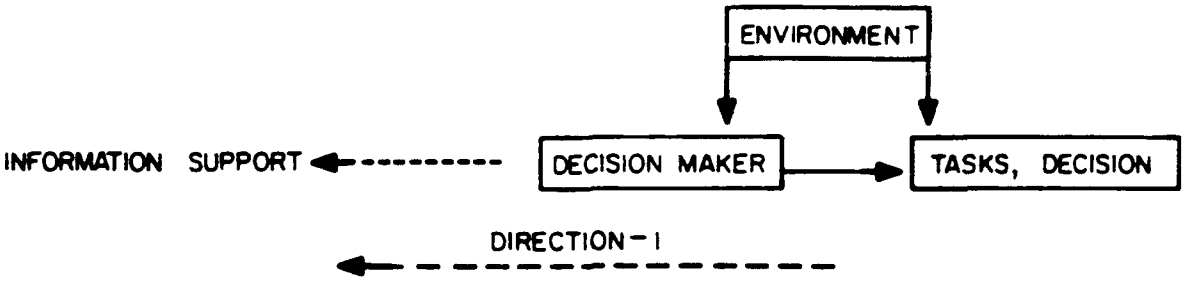
4. Make recommendations for improving the utility and the use of the Red Book.

Approach

This study approached the problem from two directions (Figure 1). First, the decision processes at the installations were analyzed to identify the requisite information to support these processes. A number of strategies were used for this purpose.[1] This study used the strategy of synthesizing information

[1] G.B. Davis, "Strategies for Information Requirements Determination," *IBM Systems Journal*, Vol 21, No. 1 (1982), pp 4-30; S.B. Yadav, "Determining an Organization's Information Requirements: A State of the Art Survey," *Data Base*, Vol 14, No. 3 (1983), pp 3-20.

requirements from the characteristics of the potential users of the information. These characteristics were determined through a questionnaire survey (Appendix) and a set of interviews. Hence, the first direction of the approach began with understanding the decisionmaking tasks and environments at the installations and following it back to the relevant data sources (Figure 1(a)). The second direction of the approach proceeded in the opposite direction (Figure 1(b)) by investigating the potential uses of Red Book data.



(a) UNDERSTANDING TASKS, FUNCTIONS, AND ENVIRONMENT OF THE DECISIONMAKER IN ORDER REQUISITE INFORMATION

(b) ANALYZING THE RED BOOK DATA IN ORDER TO IDENTIFY THE USEFUL INFORMATION THAT CAN BE GENERATED

Figure 1. Study directions.

2 INFORMATION REQUIREMENTS FOR MANAGEMENT CONTROL

The scope and requisite characteristics of an information source depend on the scope and nature of the management activities the source intends to support. Hence, the first step in identifying the potential uses of the data in the Red Book is to determine the scope of the management activities within which such data may have a relevance. The second step is to relate the specific task and decision characteristics and their complexity dimensions (discussed later) to the information requirements.

Scope of Management Activities

In general terms, the type of data reported in the Red Book can potentially be relevant to two classes of management activities: planning and control. Planning is deciding what should be done and how it should be done; control is assuring that the desired results are obtained.

Planning and control activities can further be classified into three hierarchical classes: strategic planning, task control (or operational planning and control), and management control (or tactical planning).[2] Strategic planning is the process of deciding on the goals of the organization and on the general policies used to attain them. Task control is the process of assuring that certain specific tasks are carried out effectively and efficiently. Strategic planning is performed only occasionally and at the highest level; whereas task control encompasses predefined activities performed daily. Management control activities lie between these two extremes, translating given strategies into specific task definitions and resource requirements. Table 1 relates these three levels to the Army's Real Property Management Activities (RPMA) and to the requisite information characteristics.

The characteristics of the data in the Red Book lie somewhere between the two extremes of information characteristics described in the third column of Table 1. Thus, those activities that may use the Red Book data are among the management control activities.

Management Control Process

A management control process involves six principal steps (Figure 2): programming, budget formulation, control of operations, measurement of output, reporting on performance, and evaluation.[3]

Programming

Programming is the process of deciding on the nature and size of the programs that are to be undertaken to accomplish the requirements of given long-term strategies. It involves two types of decisions: those on proposed new programs and those on the continuation of existing programs. Decisions on the continuation of existing programs will be discussed later under the subsection entitled Reporting and Evaluation.

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[2] R.N. Anthony, *Planning and Control Systems: A Framework For Analysis* (Harvard University Press, 1965).

[3] R.N. Anthony and D.W. Young, *Management Control in Nonprofit Organizations*, Third Edition (Irwin, 1984).

Table 1

Information Characteristics for Different Levels of Planning and Control Activities

Level	Example RPMA	Information Characteristics
Strategic Planning	Developing standards for measuring conditions of facilities and relating Army's missions to these conditions.	Mostly external, wide scope, aggregate, long-term, low accuracy, infrequent.
Management Control	Identifying the deviation between the existing facility conditions and standards; determining the necessary maintenance, repair, and renewal activities and the resources to eliminate the deviation.	
Task Control	Performing the specific maintenance, repair, and renewal activities.	Mostly internal, well-defined, detailed, current, high accuracy, frequent.

Programs are proposed to accomplish certain goals. For example, the Energy Conservation Investment Program set the goal of reducing the Army's energy consumption 20 percent by 1990. The numerical values in a goal statement often are determined politically or judgmentally. A cost-effective analysis in conjunction with a trade-off analysis can greatly enhance the political or judgmental process of setting goals for programs. Such analyses often require semiaggregate annual cost data from the past and projections for the future. The former is reported in the Red Book.

Budget Formulation

The budget is intended to "fine tune" programs for a given year, incorporating the final decisions on the amounts to be spent for each program using the most current price information. However, in practice, either there is no clean separation between programming and budgeting activities, or budgeting is done without considering programming guidelines. The latter is usually the case when programs do not have justifiable or well-defined goals.

An important concept that has been increasingly emphasized in the Federal Government is the use of quantified measures of the planned objectives for budgeting. It is often referred to as "Management by Objectives."[4] The idea is to quantify the objectives so that actual performance can be compared to them. The Output Oriented Resource Management System (OORMS) that the Army is currently developing is such an effort. OORMS is intended to base the Army's resource management on "feedback on execution in terms of outputs achieved for inputs planned, programmed, and then used."[5] Thus, OORMS requires feedback from the expenditures of a given year (as given in the Red Book) and the outputs of that year to determine and justify the budget for the next year.

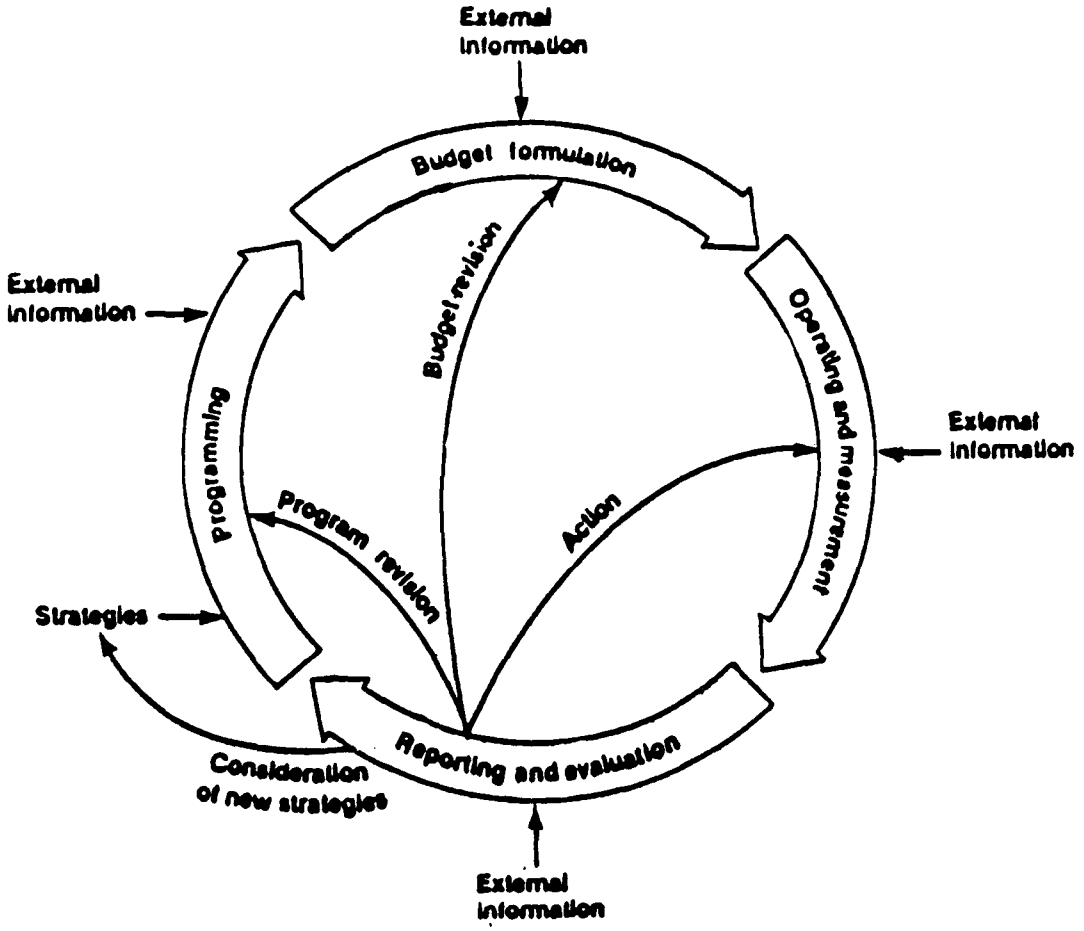

Figure 2. Phases of management control. (Source: R.N. Anthony and D.W. Young, *Management Control in Nonprofit Organizations*, Third Edition (Irwin, 1984).

[4] Rodney Brady, "MBO Goes to Work in the Public Sector," *Harvard Business Review*, Vol 51 (March/April 1973), pp 65-74.
[5] *Output Oriented Resource Management System Handbook* (Office of the Comptroller of the Army, June 1986).

Operations and Measurement

Given a budget, operations are performed and outputs from these operations are measured. There are two reasons for measuring outputs: (1) to measure for efficiency of the operations, which is the ratio of outputs to inputs (i.e., resources expended); and (2) to measure the effectiveness, which is the extent to which actual outputs satisfy the organization's goals. To illustrate, suppose Army installation A spends $10/sq ft to maintain a given facility whereas installation B spends $12/sq ft to maintain a similar facility. If the condition of B's facility is much better than A's facility, A is more efficient but less effective than B in resource utilization.

Neither the identification nor the measurement of outputs is straightforward even in profit-oriented organizations. Hence, it is an impossible task to arrive at a consensus on outputs of a nonprofit organization. The only possibility is to provide adequate information about a number of alternatives that may reflect the outputs. For example, the Army's RPMA intend to: (1) serve the people at the installation, and (2) repair and maintain the facilities. A change in either population or facilities is likely to affect the resource (input) requirements. Hence, size of the population served and the physical facilities maintained are two essential outputs measured and reported in the Red Book.

Reporting and Evaluations

After performing the operations and measuring the outputs, the next step is to review the performance and make decisions about the continuation of current programs. A summary of accounting information and a variety of other information are used in these steps. The performance review is done primarily to: (1) coordinate and control the current activities of the organization (2) assess and evaluate the performance of operations, and (3) assess and evaluate the performance of programs.

Evaluation can be done at different frequencies. For example, evaluating the percent of the annual budget already obligated is normally done monthly. Evaluation of an overall revitalization program is normally done at the end of the program which may have covered several years. Annual evaluation is a common and desirable activity that serves all three of the purposes stated above. An annual evaluation is essential for learning from past experience and from similar organizational units to improve future performance. The Red Book contains data that can be used in annual evaluations and as feedback for learning.

Decision Complexity

A given management control activity may require more than one decision. Any decision issue always involves two major dimensions: desired outcomes (goals) and beliefs (or knowledge) about cause/effect relationships.[6] Given a goal, the knowledge of the decisionmaker dictates the kinds of variables required and the manner of their manipulation to accomplish the goal. The degree of clarity of goals may vary from being very ambiguous to being perfectly clear. Likewise, either the kinds of variables or the manipulation process, hence the cause/effect relationship, can be known or unknown in varying degrees.

[6] J.D. Thompson, *Organizations in Action* (McGraw-Hill, 1967).

For analysis each of these dimensions is dichotomized as shown in Figure 3. This framework suggests four types of decision situations:

1. Goals and cause/effect relationships are both clearly known. In this case, decision problems are referred to as programmed, and the decisionmaking process requires a computational strategy. The Army's Energy Conservation Investment Program (ECIP) is a typical example. ECIP clearly states the goal level for energy conservation. Accomplishing that goal requires computing the costs and savings associated with each alternative conservation measure, and choosing the optimal ones.

2. Goals are clear, but cause/effect relationships are not clearly known. In this case, a judgmental strategy is needed. Justifying a given budget for a major construction is an example. The goal is clear: to get the necessary funds. How to accomplish this goal (i.e., justification process), however, is not clear in most cases.

3. Cause/effect relationships are clearly known, but the specific goal is not. This type of situation requires a compromise strategy. Improving the condition of a given physical facility is an example. How to improve a facility functionally or physically is a technical issue and would be known to an architect or an engineer. The desirable level of improvement, however, is usually ambiguous and cannot be specified merely by technical arguments.

4. Neither the goal nor the cause/effect relationships are clear. This type of decision situation requires an inspirational strategy. Long-term planning decisions usually fall into this category.

This framework has significant implications for determining information requirements for a given decision situation. The information should clarify the goals or increase the knowledge of cause/effect relationships. In other words, information is useful to the extent it moves a task up and left within the two dimensional space given in Figure 3.

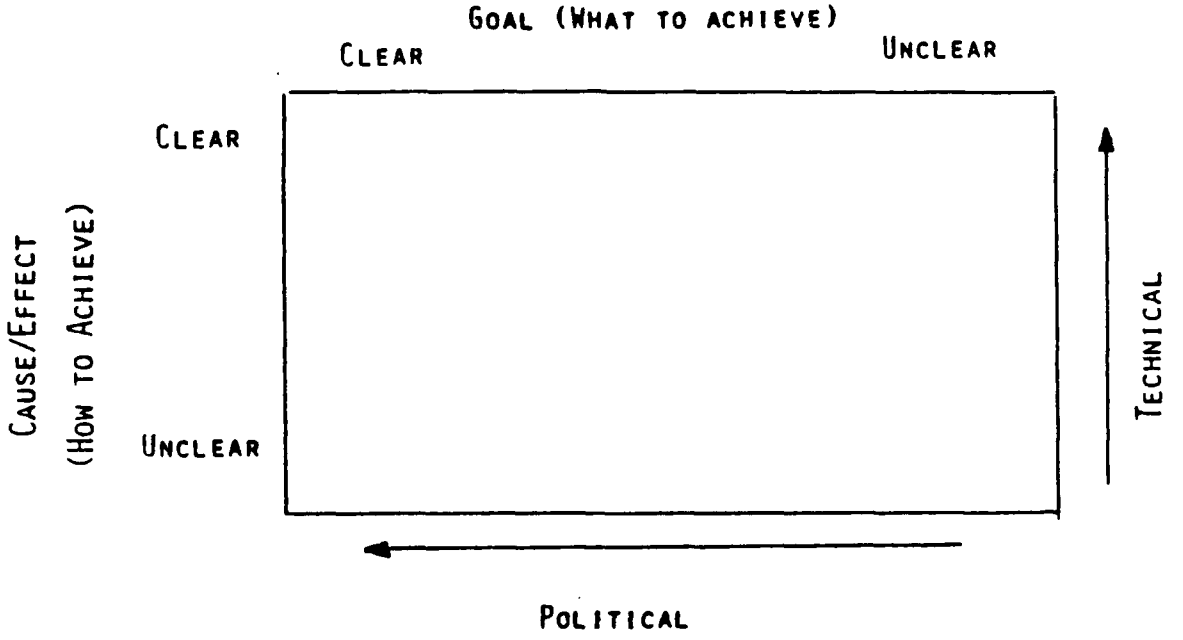

Figure 3. Decision/task complexity.

3 QUESTIONNAIRE AND INTERVIEW RESULTS

The first step in identifying the potential uses of the Red Book is to understand the work environment of the DEHs, and their communication and information needs. For this purpose, interviews were conducted and a questionnaire survey was completed.

The interviews involved open-ended questions based on the Critical Success Factors (CSF) method.[7] The CSF method suggests interviews between the analyst and the manager to identify: (1) the critical factors necessary for the manager to perform the tasks, and (2) performance measures that represent these factors. The interviews were performed at different levels of the DEH at selected installations and MACOMs. Specific questions can be grouped into three categories: (1) difficulties in successful planning, programming, and budgeting activities (2) approaches used to evaluate performance, and (3) potential relevance of the data reported in the Red Book.

The questionnaires were based on the Organizational Assessment Instruments (OAI) concept.[8] Each OAI was designed to measure various characteristics of the context, structure, and behavior of the organizational units and jobs. To accomplish this, the questionnaire (Appendix) contained the following major sections.

A - General information about the sources and uses of funds, and the unique characteristics of the installation.

B - Decisionmaking environment of the DEH.

C - Decisionmaking structure of the DEH.

D - Task interdependencies.

E - Communication characteristics of the DEH.

F - Major tasks and the way they are accomplished.

G - Performance evaluations.

H - Rules, policies, and procedures followed.

I - Information sources and their uses.

J - Questions about the Red Book.

It is important to emphasize that the questions pertaining to the Red Book were asked last both in the interviews and in the questionnaires. The following presentation of results is not in the same order of the questions asked.

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[7] J.F. Rockart, "Chief Executives Define Their Own Data Needs," *Harvard Business Review* (March-April 1979), pp 81-93.
[8] A.H. Van de Ven and D.L. Ferry, *Measuring and Assessing Organizations* (Wiley-Interscience, 1980).

Use of the Red Book

Current Use

One quick way to assess the usefulness of the Red Book is to see how often it is used by DEHs and functional units at different installations. Given the functional activities and command structure of the users, the installations were separated into three groups for evaluation: Training and Doctrine (TRADOC) installations, Forces Command (FORSCOM) installations, and others.* Major differences were identified between these three groups, not only with respect to their use of the Red Book but other characteristics as well. Differences in Red Book use between functional divisions within installations were also identified.

Figure 4(a) shows that FORSCOM and TRADOC installations use the Red Book much less frequently than other installations. These percentages are rather optimistic because those who returned the questionnaires without answering the questions about the Red Book are not included in these frequencies. Approximately 20 percent of the respondents indicated they were not familiar with the Red Book. The relative distribution of use between MACOMs did not change when these respondents were included in the calculations. Thus, even though optimistic, Figure 4 is a reasonable approximation of the respondents' familiarity with the Red Book.

Figure 4(b) shows that among the functional divisions, the Directors and the Engineering Resources and Planning Divisions are more frequent users of the Red Book. This is not surprising given they more often deal with long-term planning and budgeting activities rather than daily or weekly activities.

These functional units specifically were asked whether they analyze the information presented and whether they are content with the format of the Red Book. Figure 5 shows the results. It should be pointed out that these distributions reflect the answers of only those who use the Red Book. Results are parallel to those in Figure 4.

The interviews revealed that TRADOC has an elaborate in-house information system. Hence, their use of the Red Book, particularly for analysis, is lower than the others. The interviews also revealed that the facilities managers lack the time, staff, and tools to perform analysis. They do use the Red Book data from other installations for rough comparisons and rough estimates of unit costs.

The majority of the users (57.7 percent) prefer to report the actual expenditures (current method) rather than obligations (Figure 6).

Possible Uses

In the survey, the respondents were asked to rate three possible uses of the Red Book: (1) to make comparisons between the installations, (2) to get rough estimates on unit costs, and (3) to identify problem areas. No significant difference between these three uses was apparent across the functional units.

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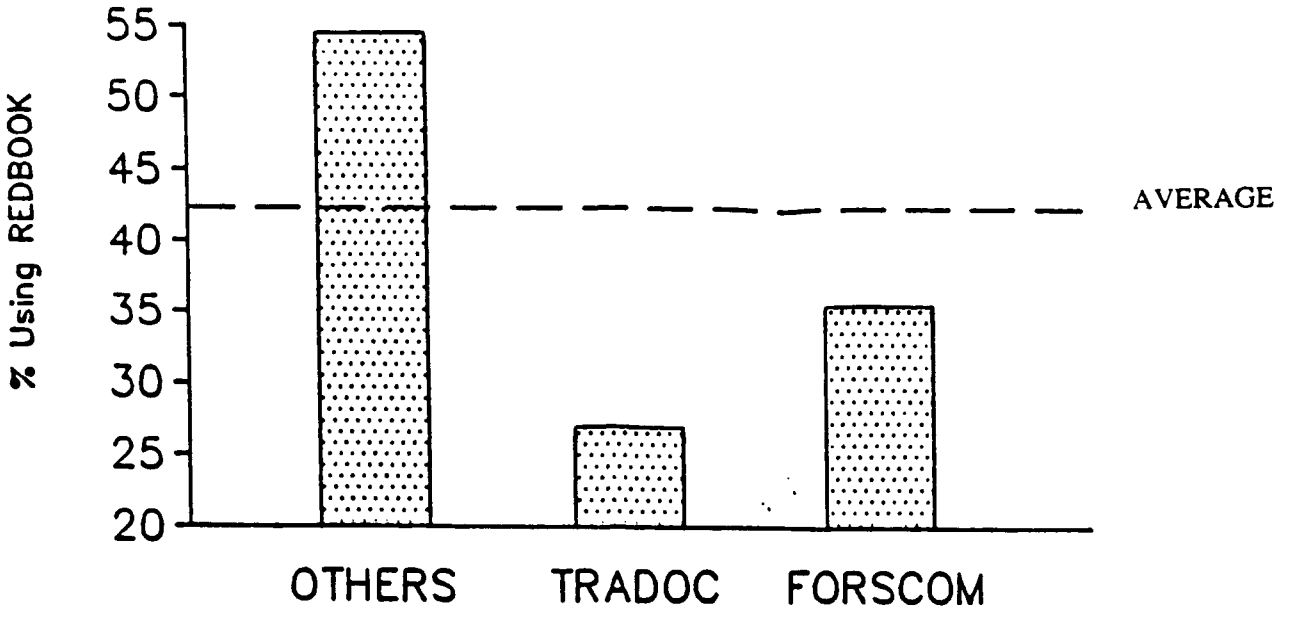
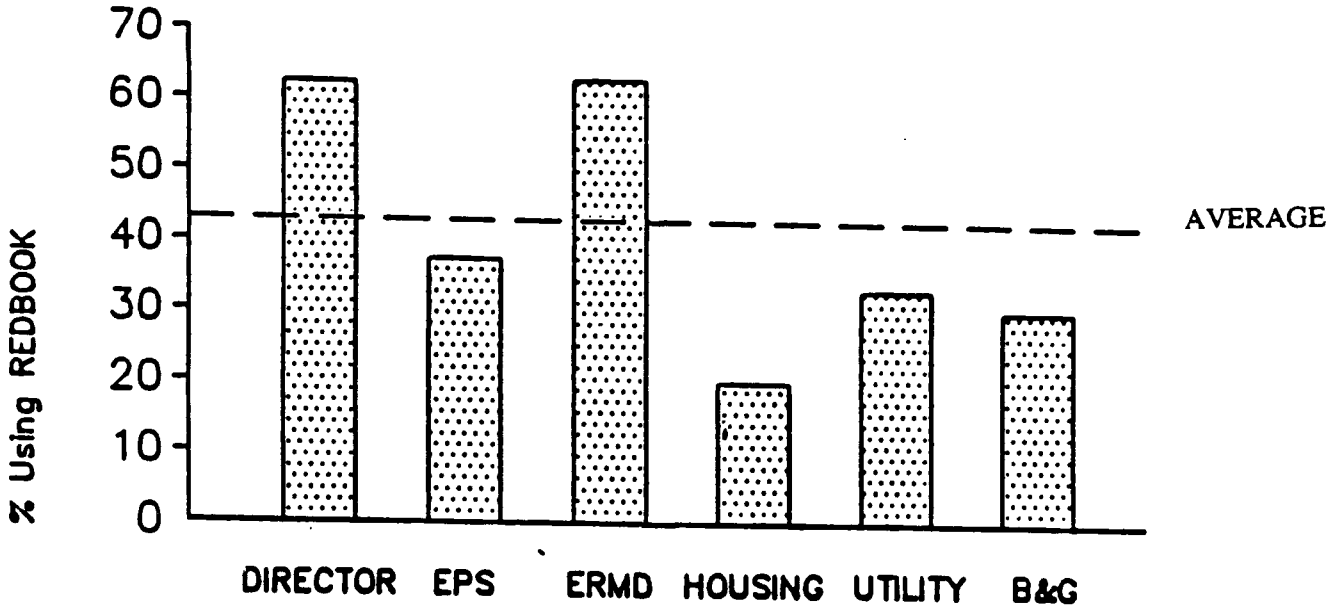
* Overseas installations were not included in these analyses because of the low return rate for the questionnaires and the very distinctly different nature of overseas installations. However, the responses from overseas installations were individually and carefully analyzed. The responses on key questions were not significantly different from installations within the United States. Some differences are noted later in this chapter.

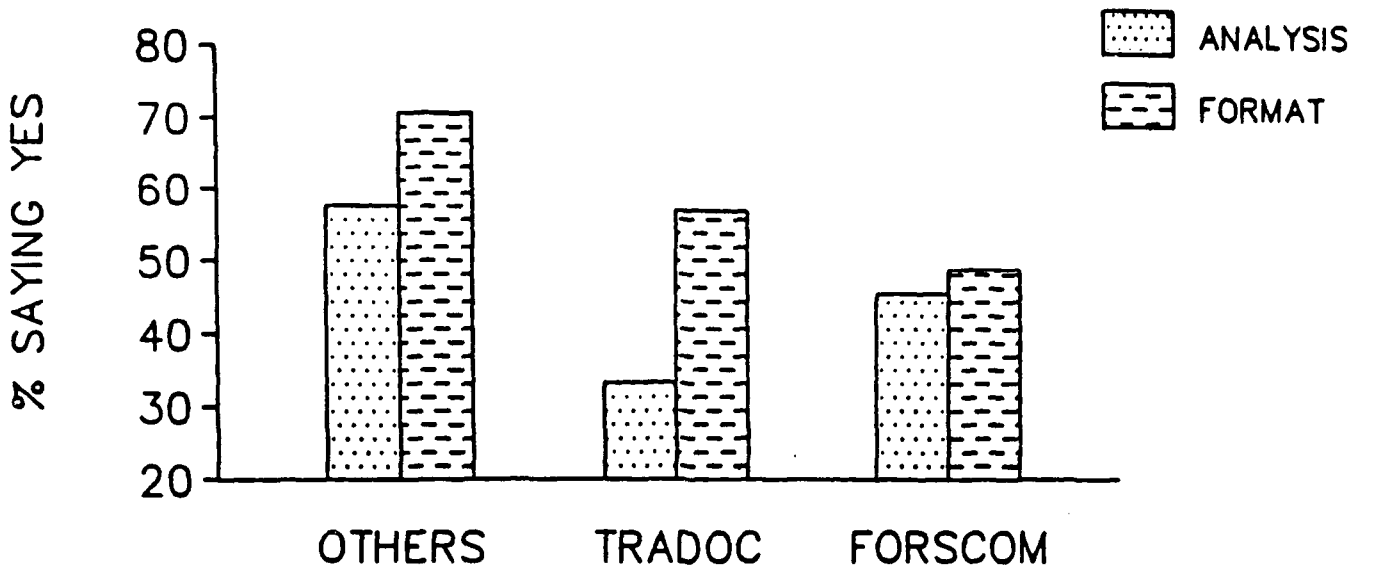


(a) among MACOMs

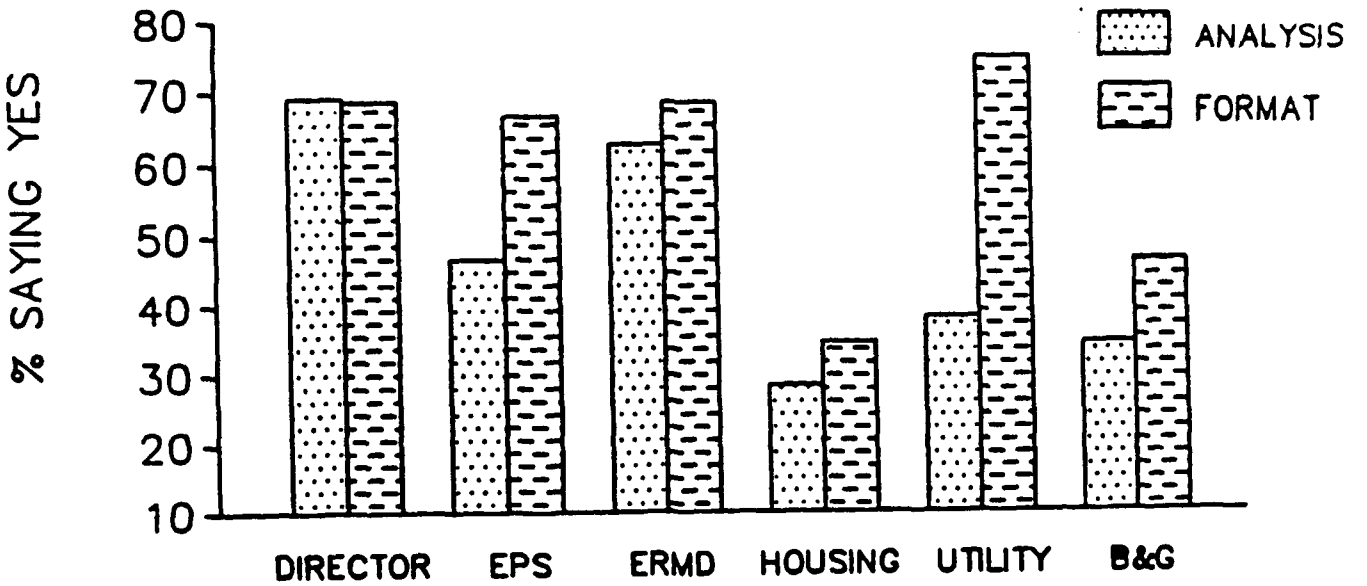


(b) among functional units

Figure 4. Usage of Red Book.



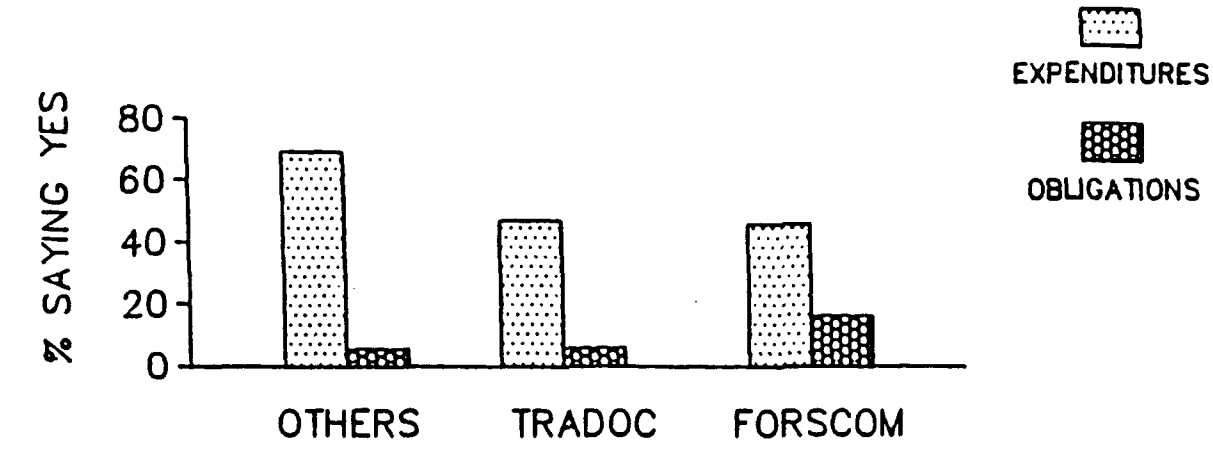
(a) installations



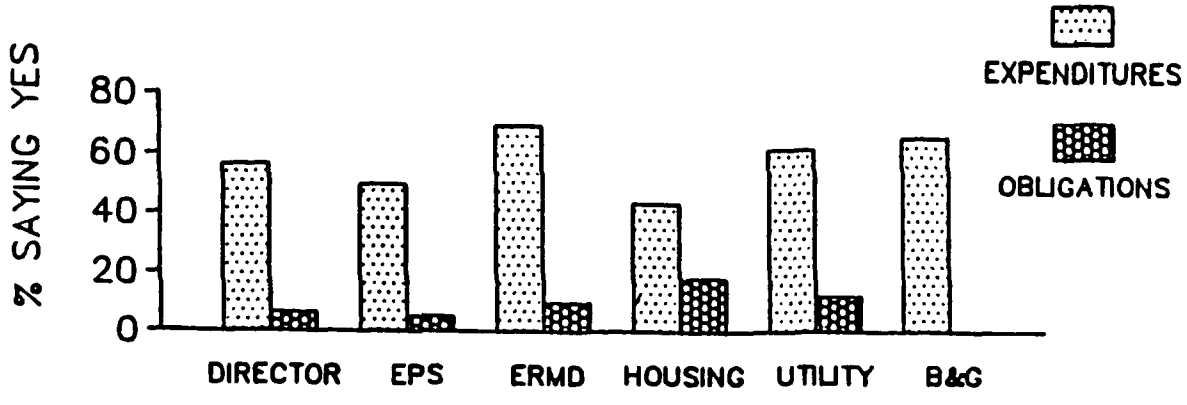
(b) major functional divisions

Do you perform any analyses using Red Book? (Average Yes: 48.30%)
Are you satisfied with the existing format? (Average Yes: 61.70%)

Figure 5. Analysis and format satisfaction.



(a) MACOMs



(b) major functional divisions

Figure 6. **Expenditures versus obligations.** (Average: 57.70 percent expenditures, 8.30 percent obligations.)

Across the MACOMs, however, statistically significant differences exist (Figure 7). Red Book data were found to be more applicable to the problem identification purposes. The interviews suggested that Red Book data are neither current enough nor accurate enough for cost estimation. Using Red Book data for comparison purposes is not favored either, because it is generally believed that the physical and operational differences between the installations preclude a meaningful unit cost comparison.

Ways of Identifying Problems

Even though most of the responses identified one of the possible uses of the Red Book as identifying the problem areas, it is interesting that the Red Book is never really used for that purpose. One of the explanations for this inconsistency is that most facilities engineers think problems can be identified by comparing results with plans rather than by comparing performances of different installations. Because the Red Book does not include any information about the plans of installations, at least in the perception of the engineers, the Red Book loses its immediate usefulness as a source of information for problem identification.

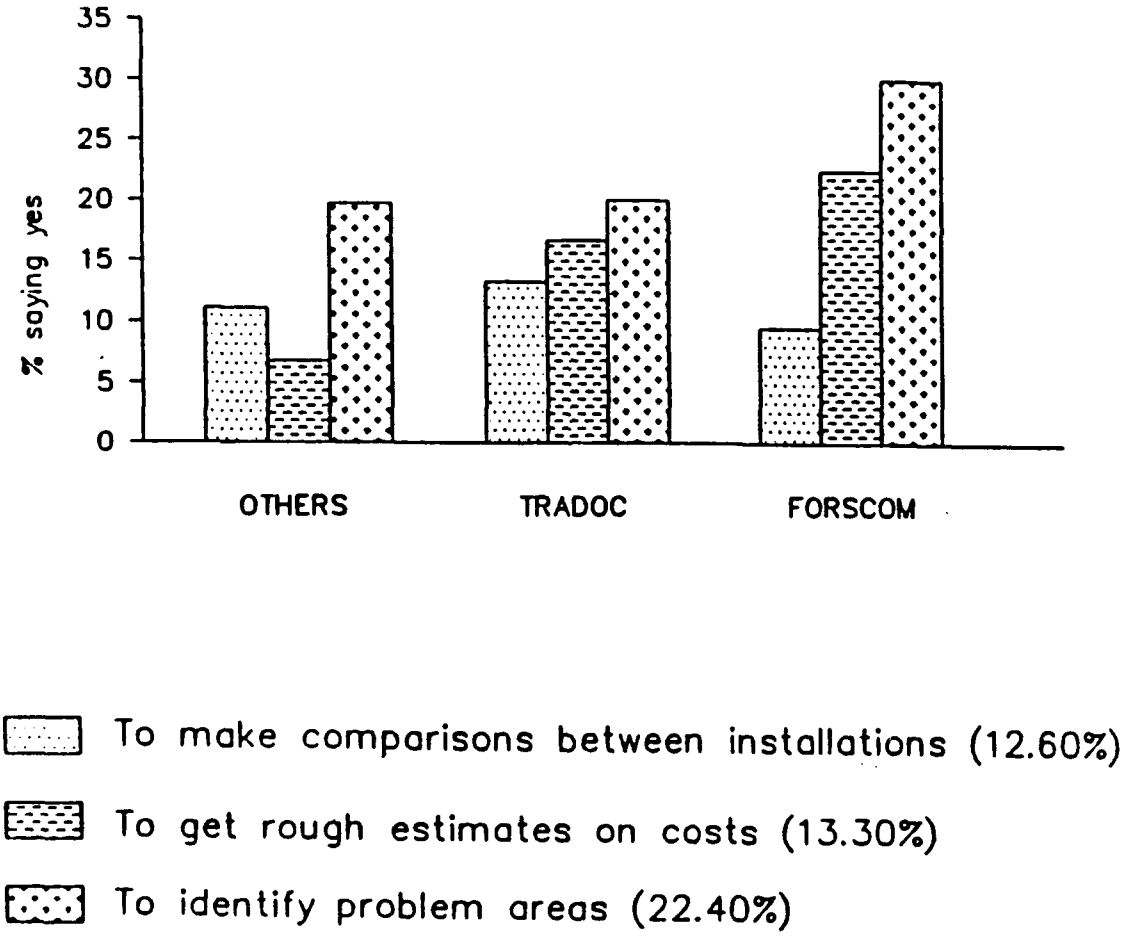


Figure 7. Possible uses of the Red Book.

Figure 8 supports the above conclusion. When the respondents are asked to choose between alternative ways of identifying problem areas, most preferred comparing their existing situation to specific plans and programs rather than historical trends, expectations of higher level managers, or to performance of other units.

The interviews offer explanations for these results. The respondents claim that for problem identification purposes, current costs cannot be compared with:

- Historical data, because the latter is not accurate and because the mission or the structure of an installation can change significantly;

- Expectations of the higher level managers (i.e., OACE), because these managers cannot accurately assess difficulties and opportunities at the installations;

- Other units, because each installation is significantly different from the others;

- Other organizations, because the Army is significantly different from other organizations.

The Task Environment

The survey was conducted to understand the information needs of the facilities engineers. As shown in Figure 9, the information needs of any managerial position are a composite outcome of several contextual factors. These factors can be identified within the following categories:

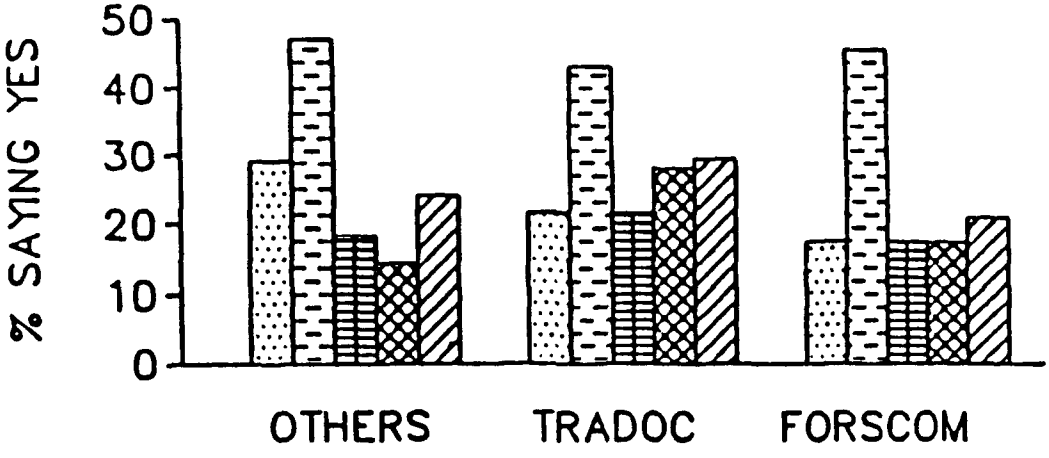
- The decisionmaking environment. Like most other organizations, DEHs must deal with multiple constituencies and take into consideration their demands. Based on the observations, nine major constituencies ranging from the Office of the Chief of Engineers (OCE) to the users of the facilities were identified. The knowledge about their demands, and their importance, influence the priorities set by the DEH for decision making.

- The types of decisions made. The kinds of decision situations faced by the organization also influence the information needs. The level of complexity of the decisions is a significant determinant of the characteristics of the information needed.

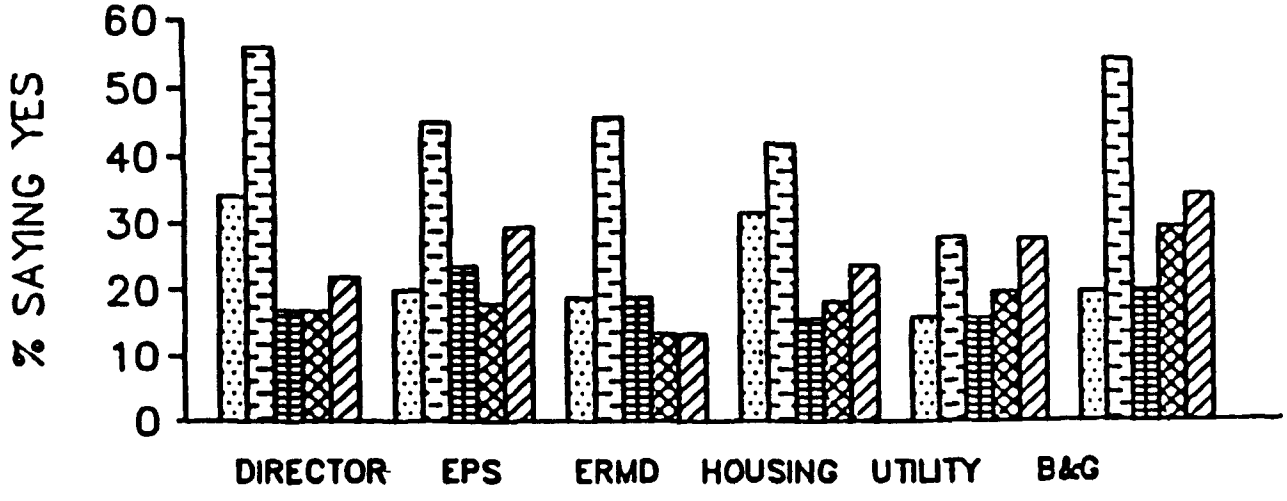
- The way performance is measured. To decide which decisions should be identified as critical, it is important to know how these decisions and their outcomes influence the performance evaluations of the unit. It is usually the case that the more a decision influences the performance evaluation, the more critical the decision becomes. The person conducting the performance evaluation must also be considered.

- Task interdependencies. The nature of task interdependencies between a focal unit and other parties of the organization usually influence the kind of information the focal unit needs. Task interdependencies may range from exchanging information to exchanging resources or clients.

These four major aspects are taken into account in the evaluation of the information needs of the DEH. The reported results are the averages for all the DEH.



(a) major groups of installations



(b) major functional divisions

Figure 8. Alternative ways of identifying problem areas.

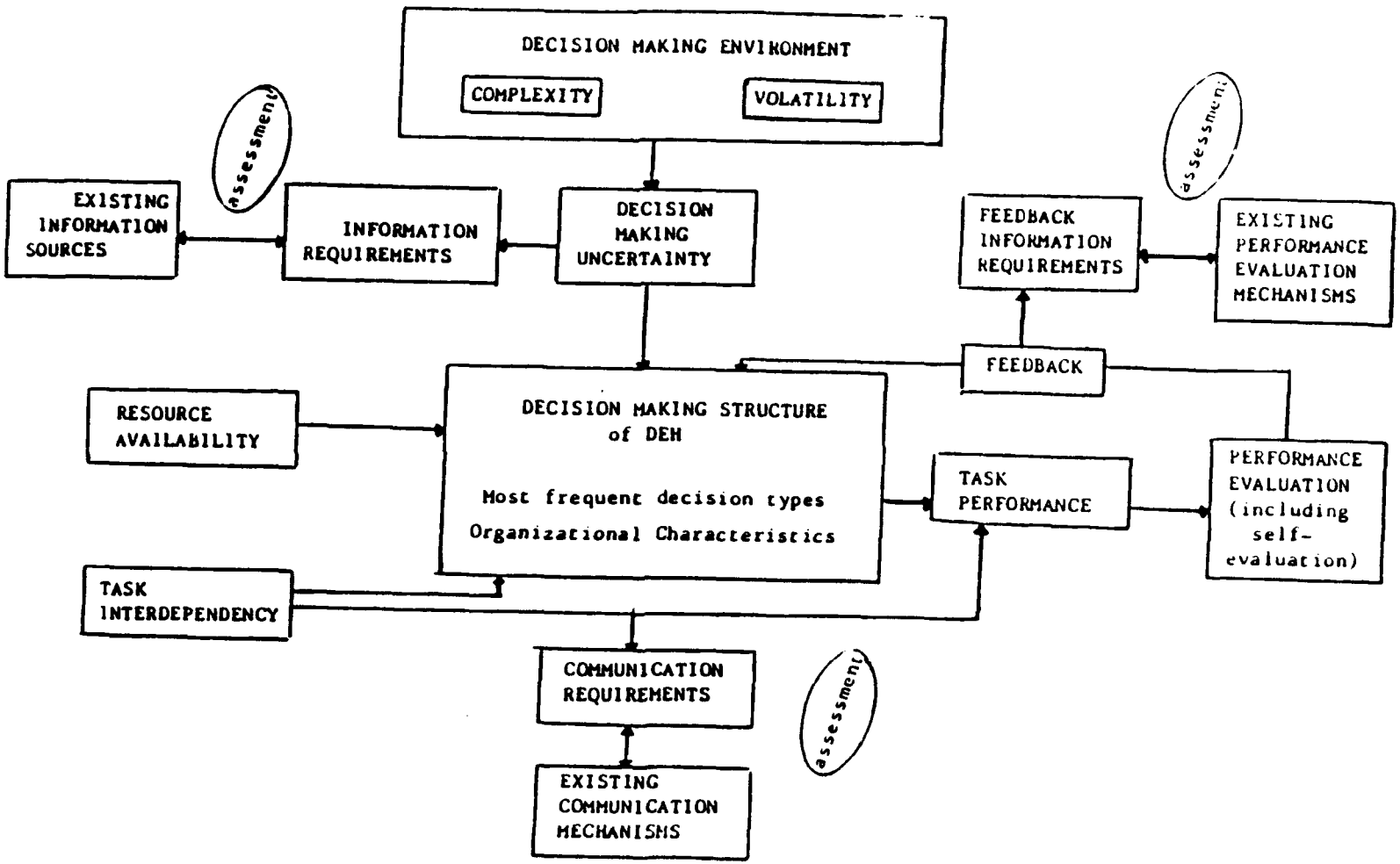


Figure 9. General design logic of the questionnaire.

Significance of the Constituencies

When all the constituencies are compared, one basic theme becomes clear. For all respondents, the line command at the installation and the users of DEH services are the most important constituencies. The contract office within the installation takes the third place in terms of critical importance. In terms of predictability of the expectations and demands of these different constituencies, the same rank order is present. From all these indicators, it is easy to conclude that for the DEHs and their functional units, the critical constituencies are the line command at the installation and the users of the installation. These results are also confirmed by additional information collected with the survey. Most respondents reported that they need to know the degree of satisfaction of these two major constituencies, and their satisfaction is the most important performance criteria for their units.

Figure 10 shows the comparisons between nine major constituencies. In the survey, these constituencies are identified as MACOMs, customers, line command, contractors, contract office at the installation, comptrollers office, local and Federal governments, and OCE. Three aspects of these constituencies were measured: (1) how well the respondent knew what each party expected from them--Awareness (2) how important each party is--Importance, and (3) how predictable the expectations and demands of each party are--Predictability.

Perceived Availability of Resources

To measure the facilities engineers' perception of resource availability for accomplishing their tasks, they were asked to evaluate eight different types of projects on a four-point scale. These projects were major new construction, major repairs, minor military construction, maintenance, repairs, improvements such as energy, environmental enhancement, and environmental restoration projects. Figure 11 shows that irrespective of their location within the organization, all respondents agree that it is the most difficult to acquire funds for major new construction. On the other hand, repairs and maintenance funds are relatively easy to finance.

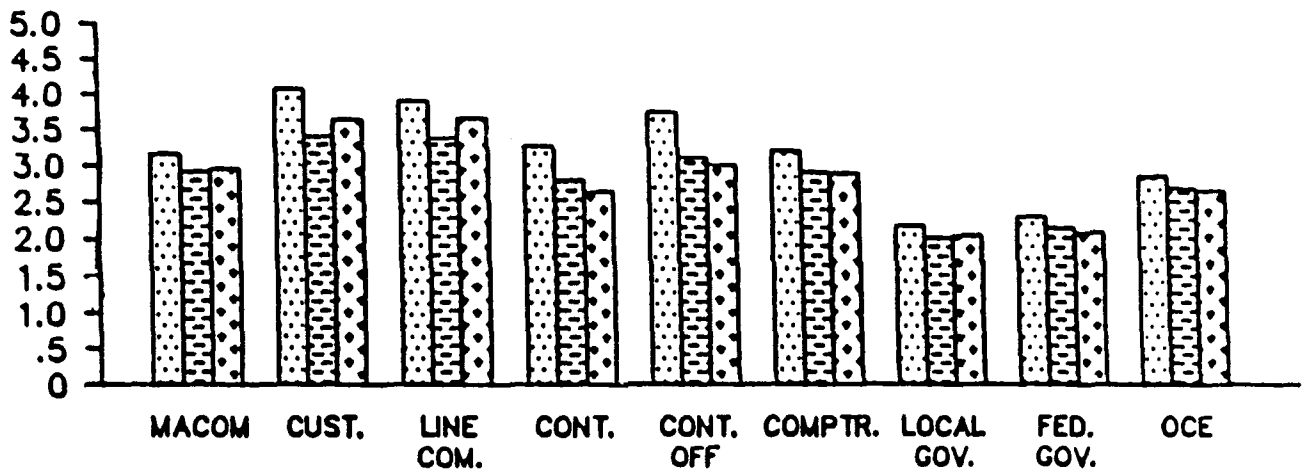
Three explanations are possible for these results. First, in general, the higher the cost, the more difficult it is to get funding. Second, high cost projects may require extensive and sophisticated justification. Lack of time, expertise, and methodological tools may contribute to the difficulties in developing adequate justifications. Third, the managerial attention focuses on satisfying short-term needs of the two most significant constituencies (i.e., customers and line command), rather than making long-range plans for justification of the major projects.

Decision Types

Decisions and tasks are classified based on the framework given in Chapter 2 (see Figure 3). An installation faces more programmed decisions and tasks than compromise decisions (Figure 12). That is, installations encounter more tasks where what to do and how to do it are clear than tasks that are ambiguous and complex. However, this does not necessarily imply that the goals are well defined and that the installations are equipped with tools and expertise to accomplish these goals. Indeed, the interview and questionnaire results imply that neither is true. The results given in Figure 13 then can be explained in three ways:

- Well defined daily tasks are generally more numerous,
- The expectations of the most critical constituencies (line command and users of the facilities) are well known and daily tasks to satisfy the constituencies are the focus,
- Because of the lack of information, tools, and expertise, more complex problems are not even noticed or do not get enough attention.

The interviews indicate all of these explanations are true. One major implication of these results is that the information perceived as most necessary is oriented more toward short-term results.



Selected Constituencies

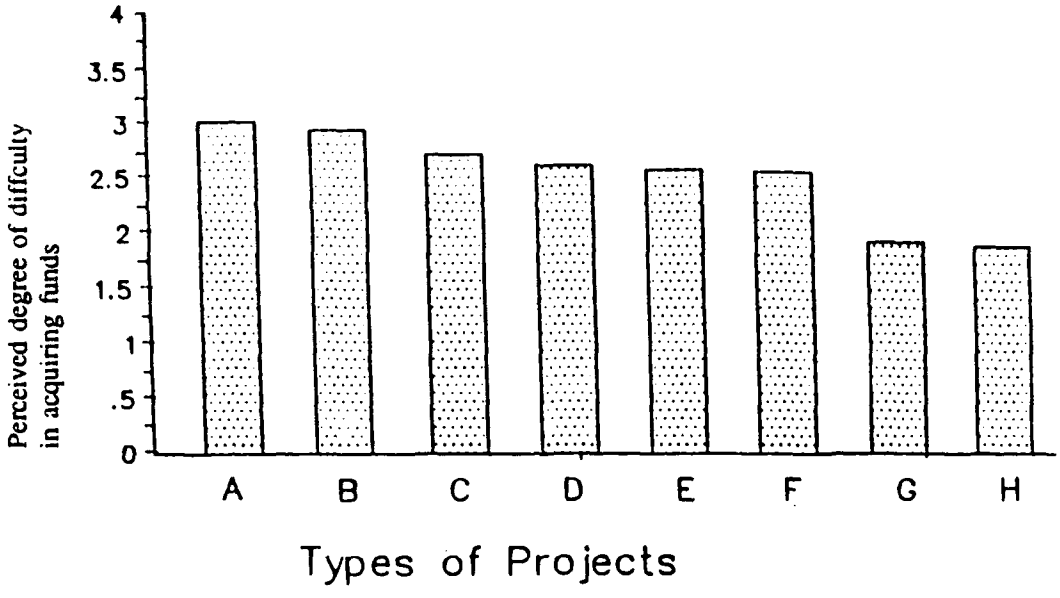
Three aspects of these constituencies are measured:

Awareness (How well the respondents know what these parties expect from them).

Importance (How important are each of these parties).

Predictability (How predictable the expectations and demands of these parties are).

Figure 10. Significance of the constituencies.



A. Major new construction
B. Major repairs
C. Minor military construction
D. Restoration
E. Improvements
F. Enhancement
G. Repairs
H. Maintenance

Figure 11. Resource availability for eight types of projects.

Performance Evaluation

Most DEHs indicated they measure and evaluate the performance of their units (Figures 13 and 14). Major differences between the functional units and the major groups of installations were not found on this issue. Two interpretations of these findings are possible. On one hand, it is possible to argue that the findings indicate a healthy organization in which decision making and performance evaluations are delegated within the organization. On the other hand, it is also possible to argue that little or no direction is given by the higher levels. The only indication in favor of the second explanation is an occasional complaint about the lack of standards that the upper level of the organization could provide. Therefore, the conclusion is that the first explanation is a more reasonable one. When the previous results are combined with some additional information, such as the degree of autonomy perceived by the respondents, findings can be evaluated from a positive point of view. One possible danger in this situation, however, is the lack of a standard performance evaluation. Given the fact that most units believe their needs and other characteristics are unique, there is an established opinion that the performance of different units cannot be compared. This creates a problem in measuring the efficiency and effectiveness of an installation's operations. Hence, they rely on keeping the line commander and users content. Almost everyone interviewed realizes the inadequacy of these criteria.

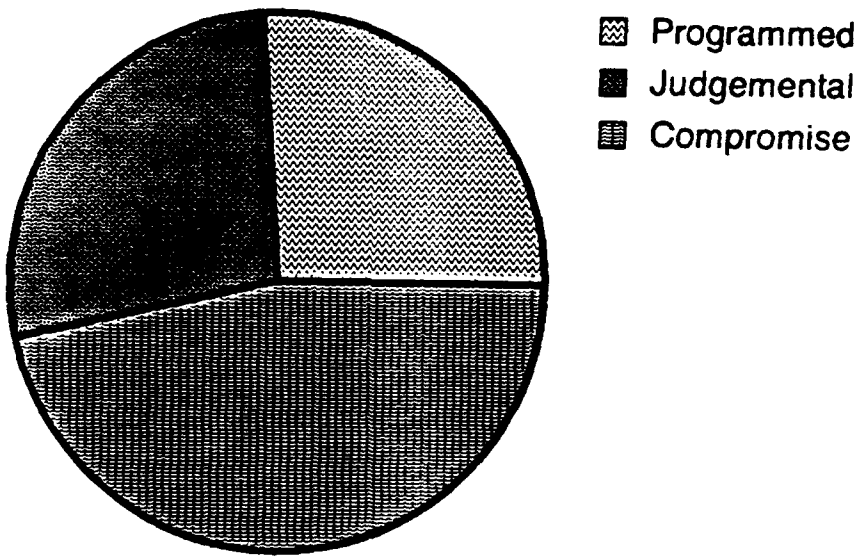


Figure 12. Distribution of decisions.

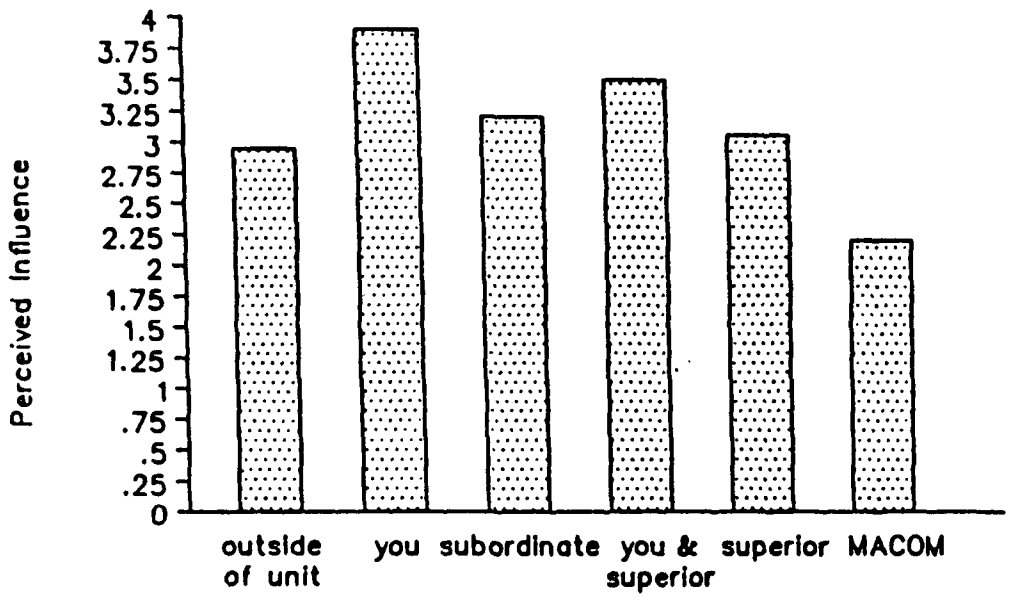


Figure 13. Parties deciding on performance criteria.

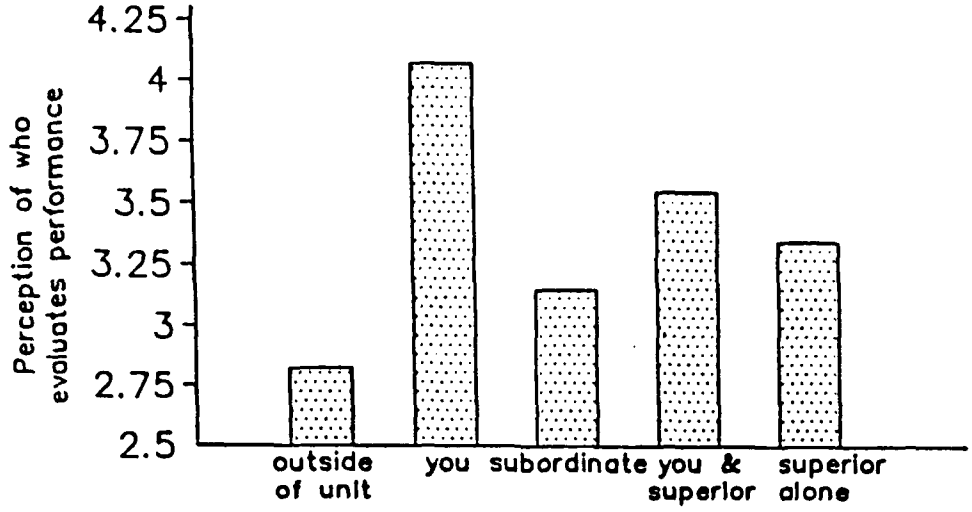


Figure 14. Parties making performance evaluations.

Goals

The survey also asked the respondents about their ideas on goal clarity and goal difficulty. No major differences on the perception of goal clarity were evident between MACOMs. They all feel that the targets are relatively clear. As expected, however, there are differences between the functional units (Figure 15). Because of their position within the organization, directors are less clear about what their goals should be. On the other hand, questions on goal difficulty showed differences between MACOMs (Figure 16). FORSCOM installations perceive their goals as more difficult and TRADOC installations perceive their goals as relatively easy. This is partly due to the closely monitored relationships between TRADOC headquarters and its installations.

One final factor that influences the information needs of managers is the task interdependencies between the managers and other units in the organization. Different aspects of their tasks, ranging from information exchange to resource exchange, necessitate the use of different types of information sources. The results indicate that most major task interdependencies as perceived by the respondents exist between parties at the same level in the organizational hierarchy. The second group of interdependencies are with those units for whom the interactions are mandated by law or regulation. Figure 17 shows the average distribution of these interdependencies for all installations. In this category, there were no major statistical differences between MACOMs or the functional units. The only substantial difference was between the TRADOC installations which showed more than the average number of interdependencies between other equal parties (Figure 18).

Table 2 gives a rank order of these interdependencies for each of the functional units within the DEH. For convenience and clarity, the interdependent units are divided into two major groups: units within the installation, and units outside the installation.

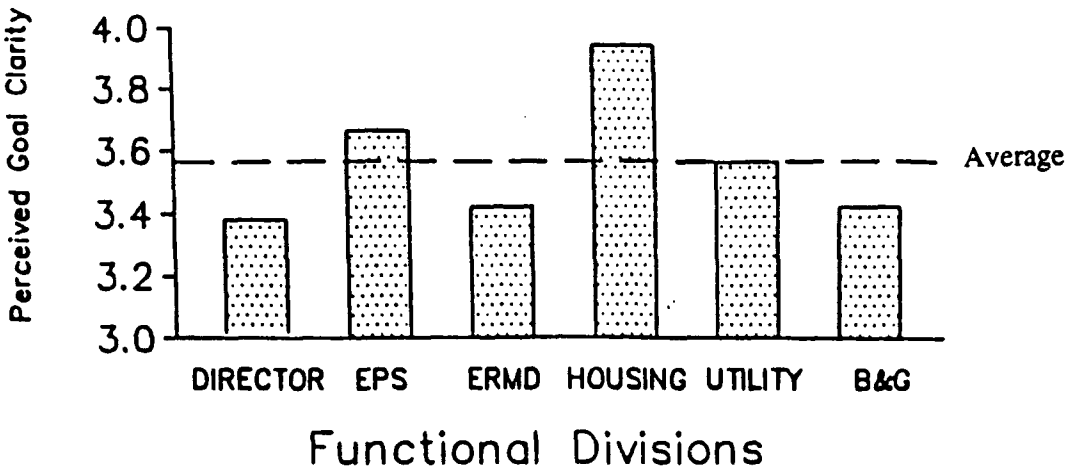


Figure 15. Perceived goal clarity.

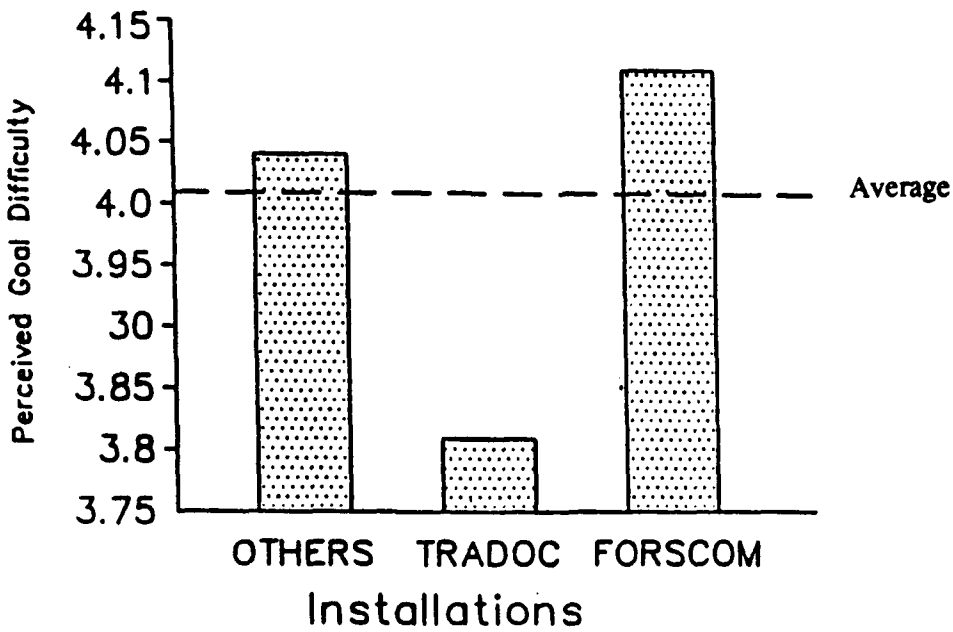


Figure 16. Difficulty in accomplishing the perceived goals.

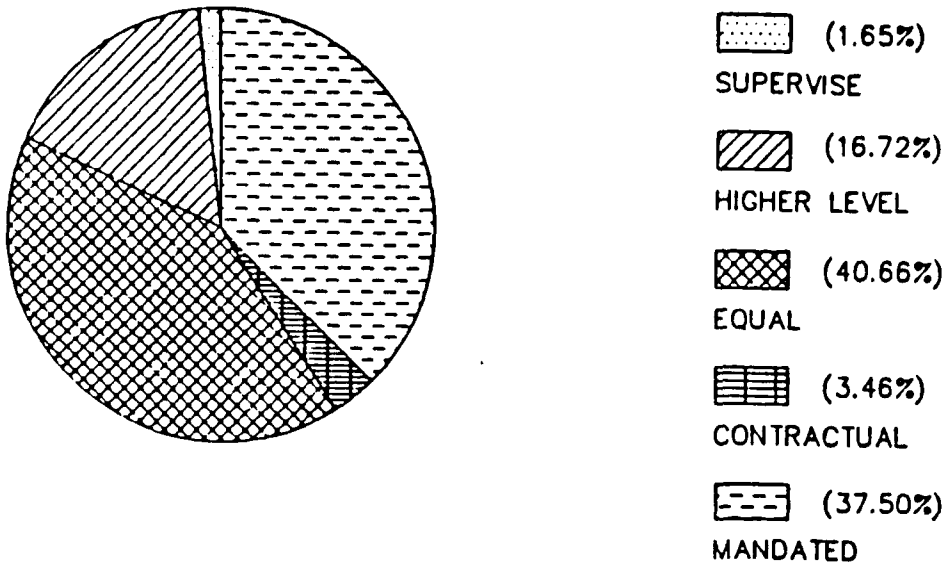


Figure 17. Distribution of perceived interdependencies.

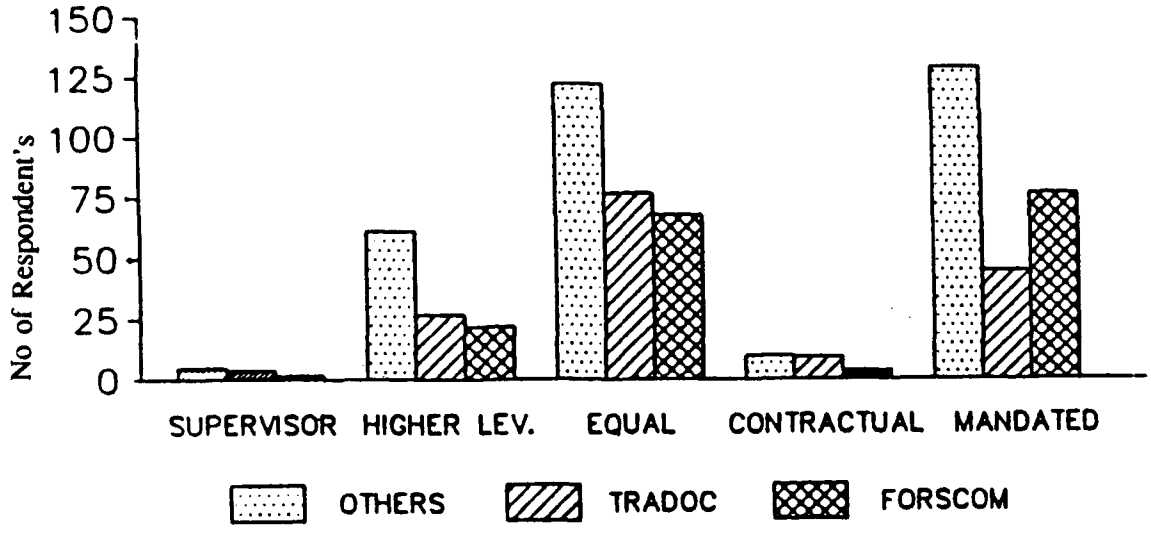


Figure 18. Perceived interdependencies.

Table 2

Rank Order of the Most Critical Interdependencies

Within the Installation

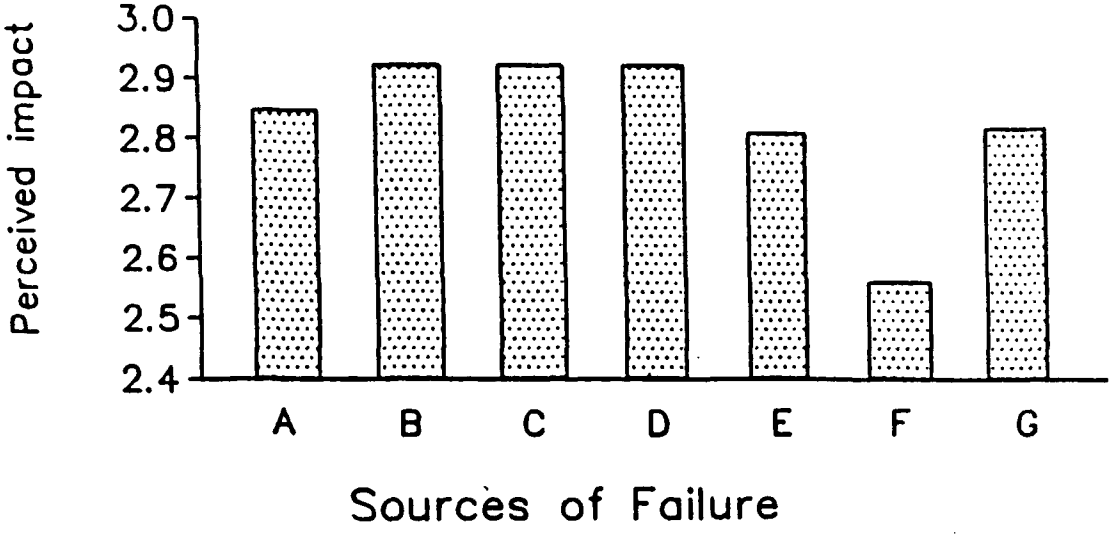
DEH Function	Other Functions	Hierarchic	Others	External
Director	Engineering Plans & Svcs (EPS) Engineering Resources Mgt Div (ERMD) Housing	Commanding Officer District Engineer	Contracting Comptrollers	MACOM OCE State Officials Contractors
EP&S	ERMD Users Housing Utilities	Director District Engineer Commanding Officer	Contracting Comptrollers Procurement	Contractors
ERMD	EP&S Utilities Housing Bldgs & Grounds (B&G)	Director Commanding Officer	Comptrollers Contracts Personnel	
Housing	ERMD	Commanding Officer	Comptrollers	Real Estate Agencies
	EP&S	Director	Contracts	Supply Companies
			Purchasing	Landlords
Utilities	EP&S ERMD	Commandering Officer Director	Contracts Comptrollers	Federal Environmental Protection Agency (EPA)
	B&G Housing			Utility Companies State EPA
B&G	EP&S ERMD Utilities	Director District Engineer Commanding Officer		

Within installations there are three subgroups: other functional divisions within the DEH, higher hierarchy, and others. The results presented in Table 2 indicate that for most functional areas, perceived interdependencies are between other functional divisions and the commanding officer of the installation rather than higher levels within the Corps.

Sources of Information and Organizational Performance

How Critical Is Information?

To identify how critical the installations perceive the information for performing their tasks, several major factors for performance failure were identified: lack of financial resources, lack of communication, lack of trained personnel, lack of information, lack of higher level support, selection of improper targets, and lack of available method (software and hardware). For all DEHs, communication, trained personnel, and information are identified as the critical factors behind failure to achieve objectives (Figure 19). On most items, there was no significant difference between MACOMs, except in the cases of financial resources and information. In both cases TRADOC installations perceived these two factors as more critical than the other groups of installations (Figure 20). The differences between functional units, on the other hand, are related to the lack of higher level support and the selection of improper goals. As shown in Figure 21, both the directors and the utilities divisions perceive the lack of higher level support as more critical for performance than other units within DEH organizations. Utilities divisions perceive the selection of improper goals more critical than other functional units for goal accomplishment.



A. Lack of financial resources
B. Lack of communication
C. Lack of trained personnel
D. Lack of information
E. Lack of higher level support
F. Selection of improper targets
G. Lack of available method (software and hardware)

Figure 19. Perceived causes of performance failure.

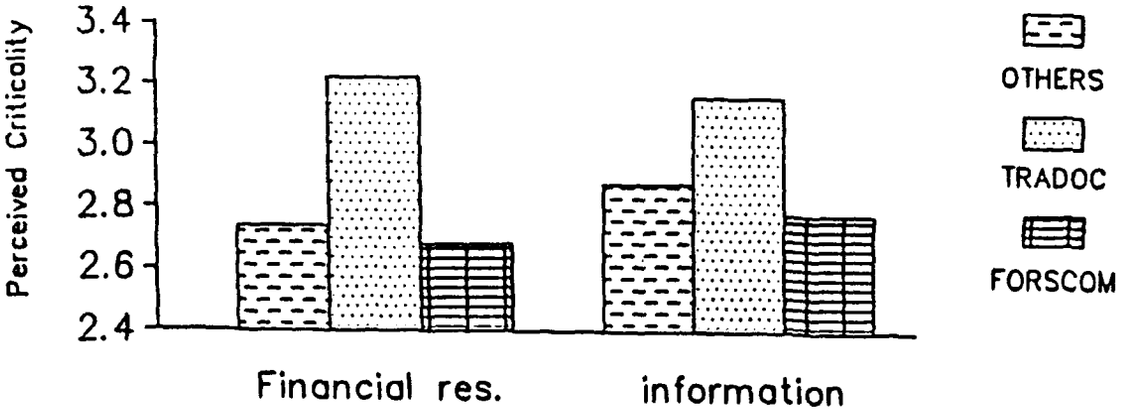


Figure 20. Differences between MACOMs on the causes of performance failure.

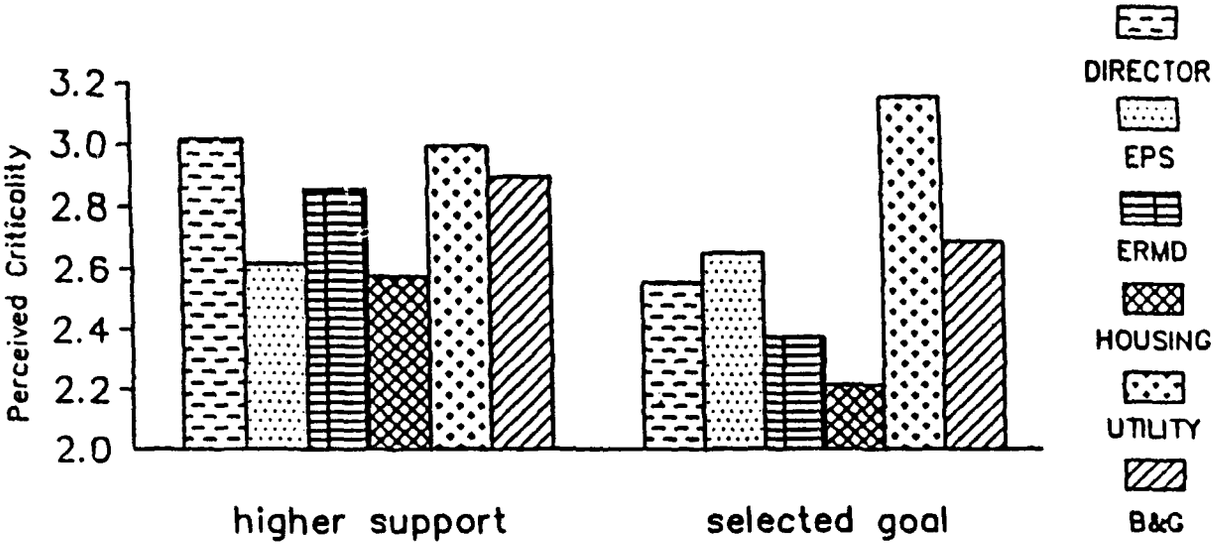


Figure 21. Differences between functional areas on the causes of performance failure.

These results, when combined with the interview results, pose interesting paradoxes:

- According to Figure 19, selection of targets is the least significant cause of failure according to all respondents. However, utilities divisions disagree (Figure 21). It is interesting that only utilities divisions have a specific target (energy conservation). In view of these results and the interviews, it is plausible to state that targets generally pose no difficulty because they do not exist.

- According to Figure 20, lack of information is perceived to be more problematic by TRADOC than by FORSCOM. Again, it is interesting that TRADOC has a much more elaborate and extensively used information system than the latter.

- According to Figure 20, financial resource availability is perceived to be more problematic by TRADOC than by FORSCOM. Again, interestingly, TRADOC has a more sophisticated and elaborate budgeting process.

One possible explanation of these three paradoxes is that awareness of a problem increases as more attention is paid to a given situation. The paradoxical differences between TRADOC and FORSCOM may also be explained by their significantly different functions. TRADOC deals with a well organized and stable "student" population whereas FORSCOM deals with the "warriors" in a dynamic and complex environment.

Quality of Information Sources

Given the critical need of information for task performance, the next issue is to identify the existing problems with the information sources that are most frequently used by the DEHs and functional units. The survey questionnaire asked the respondents to identify four major sources of information they use most frequently and measure the source's quality. Quality was measured in five different aspects: usefulness of the information, accuracy of the information, timeliness of the information, ease of accessibility, and the format of the information. Instead of measuring perceived quality of specific information sources, the respondents evaluated those sources they use very frequently. They also rated these sources in terms of frequency of use. All these scales were five-point scales.

As Figure 22 indicates, the information sources selected by the respondents are indeed used frequently. However, most respondents agreed that most of the sources are not accurate or timely and are not in a useful format. There were no statistical differences between the functional units with respect to perceived quality of information. The only difference between MACOMs was related to the usefulness of information. TRADOC installations were much more critical about the usefulness of the available information than the other two groups (Figure 23). The paradox, again, is that TRADOC has an extensively used and elaborate information system.

Source of Critical Information

One additional aspect of useful information is the source of the information itself. As Figures 24 and 25 indicate, most of the information used at the installations is generated in-house. On the average, 45 percent of the respondents indicated that the information used by them is provided internally either by their own functional unit or the DEH as a whole. There is no real difference between TRADOC and FORSCOM with respect to the source of information. On the other hand, all other installations indicate that most of the information (60 percent) is externally provided.

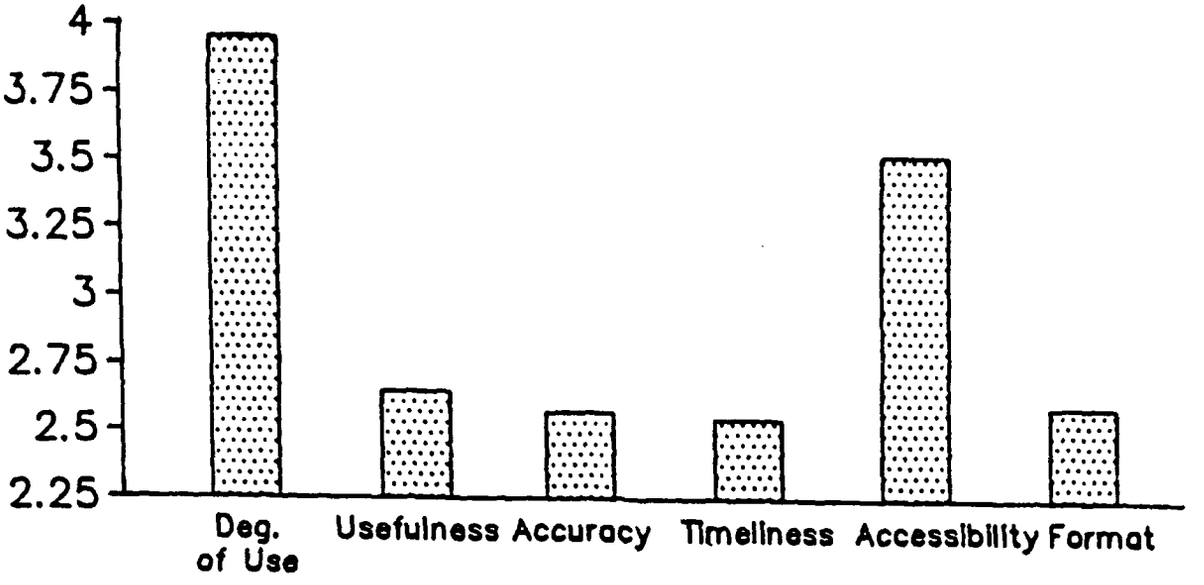


Figure 22. Characteristics of information sources.

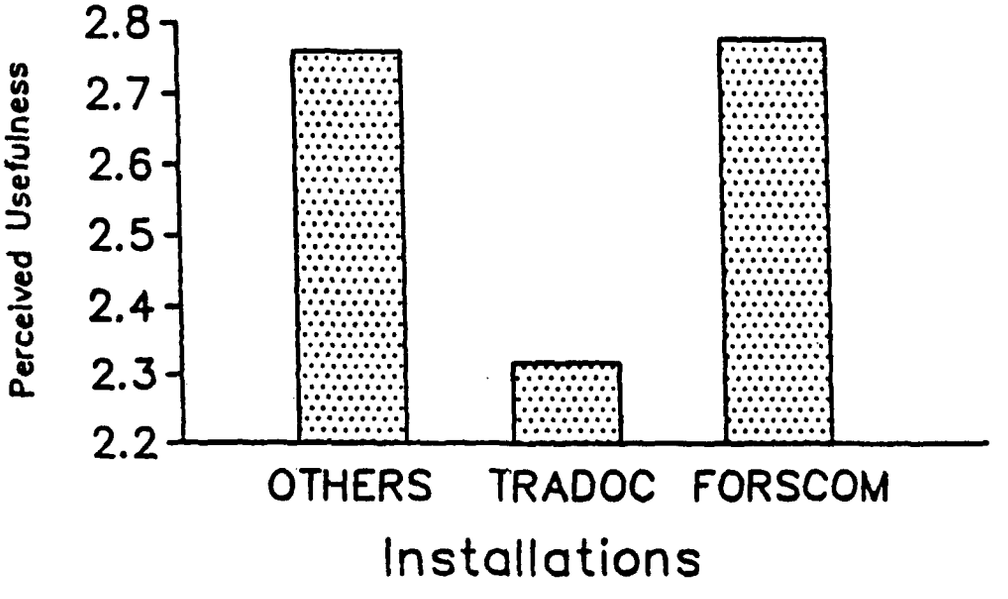


Figure 23. Differences on the usefulness of the available information sources.

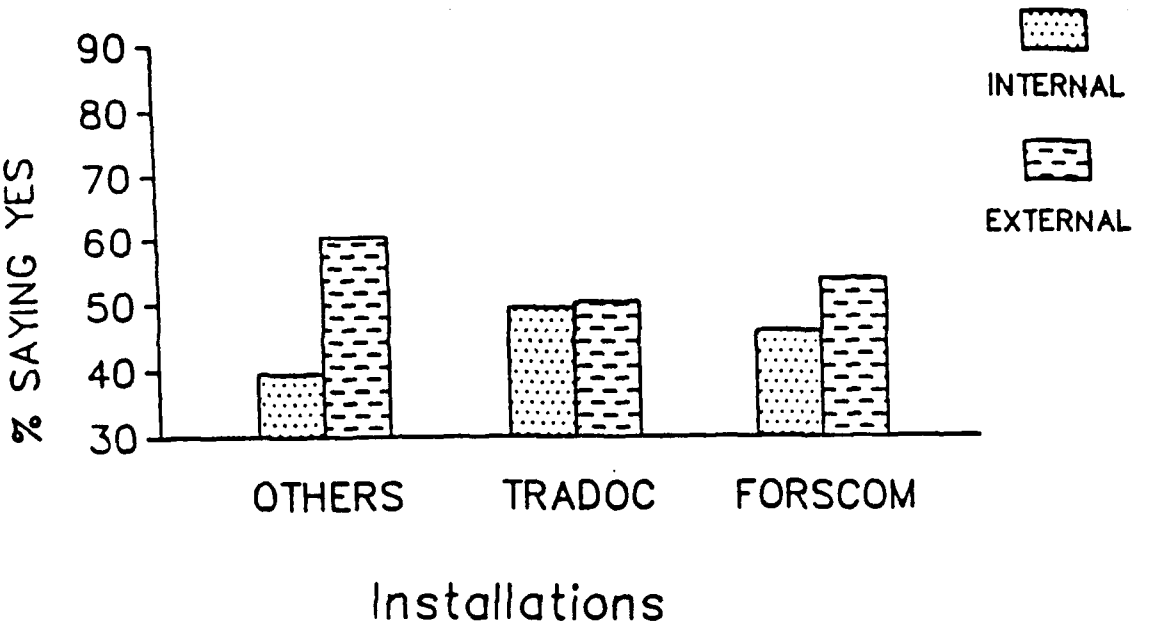


Figure 24. MACOM sources of information.

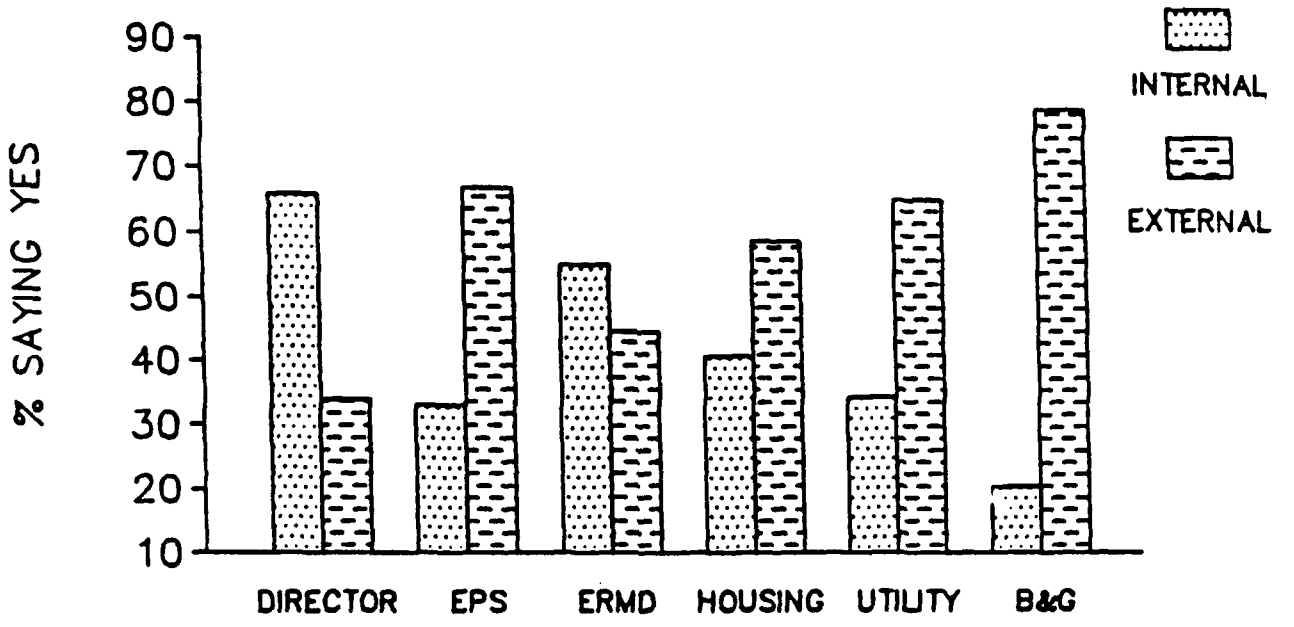


Figure 25. Functional unit sources of information.

Even though there are no major differences between MACOMs, major differences between the functional units exist. As shown in Figure 25, the use of internally generated information ranges from 65 percent (Directors of Engineering and Housing) to 20 percent (Buildings and Grounds).

Information and Performance Evaluation

One important aspect of the survey was to find out how facilities engineers measure their performance and what information sources they use for this purpose. Table 3 lists the evaluation criteria. As mentioned earlier, the most critical constituencies for the DEH personnel are the customers and the installation officers. As a result, they measure performance with respect to the satisfaction of these two critical groups. For the director, ERMD, housing, and utilities, customer satisfaction is the most critical criteria for measuring their performance.

Table 3 also shows that the sources of information for measuring performance are mostly heuristics, which are developed based on local needs, rather than any type of Army-wide standardized information source. Table 3 was prepared using the responses to the open-ended questions. Standardized responses were not provided. The degree of consistency among the answers was very striking and consistent with the other results derived from the questionnaire.

Information and Task Performance

Another type of information critical for the facilities engineers is the information relevant to performing their tasks. As in the case of performance evaluation information, the questionnaire asked the respondents to indicate four of the most common sources of information used when they performed their tasks. Again, most of the responses indicated that they use local sources of information. Table 4 gives a partial list of the common responses based on command group.

In addition to these local information sources, five major sources are frequently reported as useful. Figure 26 gives the relative frequencies of these five sources for each MACOM. The Annual Work Plan (AWP) is still the most critical source of information with respect to identifying and planning what needs to be done at an installation. Even at TRADOC installations where the importance given to the AWP is expected to be less, the results show that, in relation to other standard sources of information, it is still a critical information source. It must, however, be noted that most installations have developed a concept, format, and procedure for the AWP that differ from what is required by OCE.

Unavailable but Needed Information

One of the open-ended questions in the survey asked the respondents about the types of information they need that are presently unavailable. The results give some important insights about the existing information needs of the facilities engineers. The respondents not only identified different types of needed information, but also pointed out that they need methods to use information.

Table 3

Performance Evaluation Criteria and Their Sources

Functions	Performance Criteria	Sources
Director	Customer satisfaction	Informal and formal reports
		Personal contacts
		Customer feedback
		Command channels
		Oral and written feedback
		Customer assistance line
		Word of mouth
		Townhall meetings
	Command satisfaction	Verbal/written complaints
		Timedata vs priority
	Mission accomplishment	Own evaluation
	Annual work execution	Annual Work Plan (AWP)
	Work done on time	Review WRKPERF. sheets
EP&S	Satisfy command interest	Command response
	Funds allocation	AWP
	Funds obligation rate	Budget
		Yearly project schedule
	Establishment of priorities	AWP
	No. of projects designed	Internal design list
	Timeliness	AWP
		Monthly design status
		User
	Customer satifaction	Customer feedback
	Technical adequacy	Contract modifications
ERMD	Customer satisfaction	Phone calls from customer
		Backlog and customer input
		Customer surveys
		Customer complaints
	Planned work & goal accomplished	AWP
	Amount of jobs	Engineering status reports
	Review of service orders	IFS reports
	Productivity	Monthly DEH mgt reports
Housing	Customer satisfaction	Personnel feedback
		Customer comments
		Complaints
		Letters, verbal comments
	Adequate quarters	Inspections
	Occupancy rate	Occupancy data
		AR 210-50
		Annual and interim reports
		Daily housing reports
	Obligation of funds	Comptroller's reports

Table 3 (Cont'd)

Functions	Performance Criteria	Sources
Utilities	Command satisfaction	Verbal feedback DEH direction
	Customer satisfaction	Contacts with users
	Utility interruptions	Reports Historical records
	Review of service orders	Integrated Facility
	Maintenance and Repair (M&R) performed	System (IFS) reports Facility Engineering Supply System (FESS) & Viable Data
B&G	Command satisfaction	Written and verbal feedback
	Service order backlog	IFS records, schedules
	Performance efficiency	Command knowledge
	Work accomplished	Records Completion rate

Table 4

Task Information

Command Group	Source
TRADOC	Budget reports DEH weekly meetings Daily command input TRADOC newsletter TRADOC M&R project reports
FORSCOM	In-house design status reports Individual Job Orders (IJOs) Review and analysis meetings
OTHERS	Internal review and analysis Worksheets Budget performance reports Weekly meetings

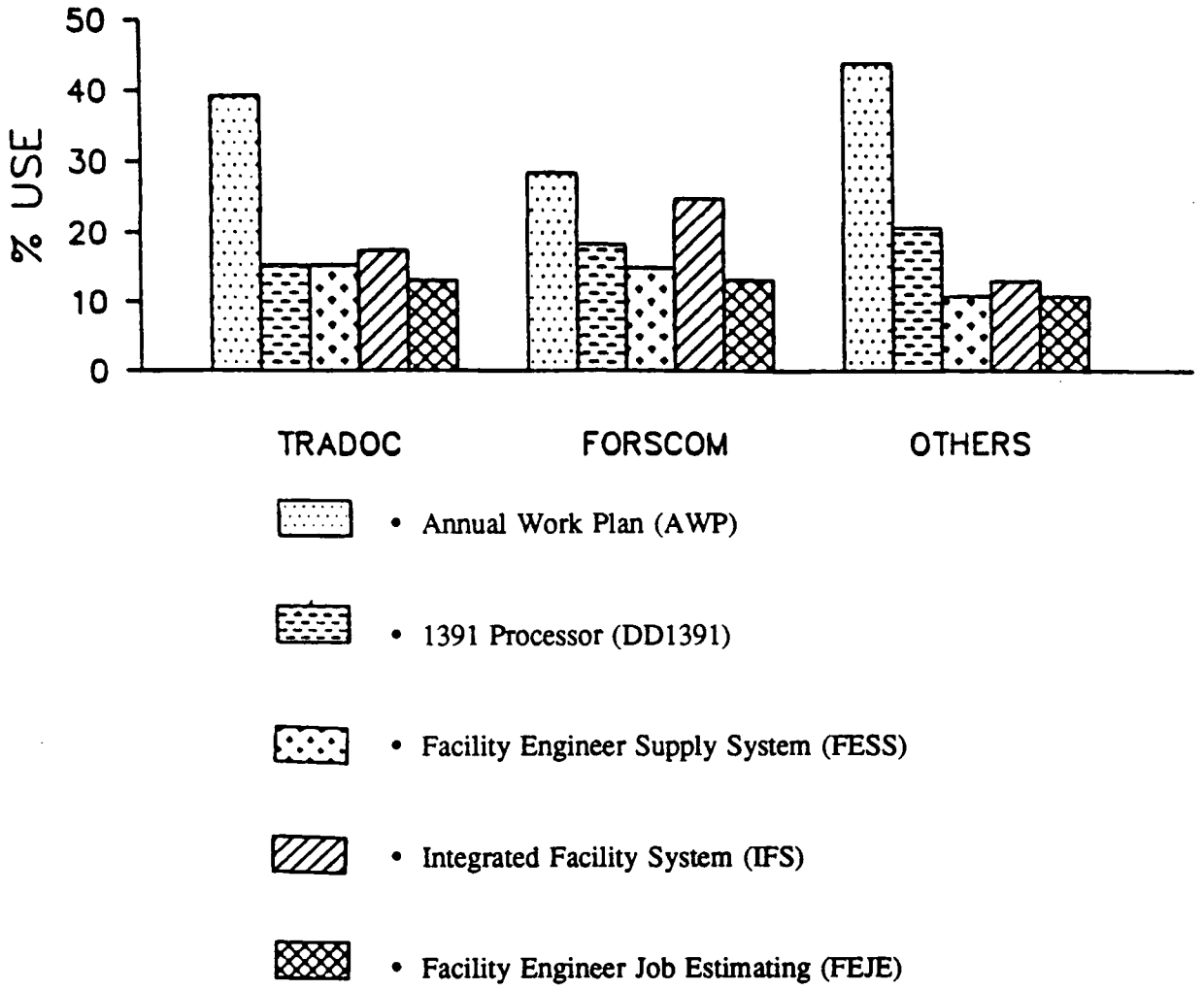


Figure 26. Relative use of common information sources.

The responses were classified into three main categories:

A - Method and Equipment Needs

Examples:

Automated planning system
Automated work control system
Comprehensive work management system
Realtime automated cost accounting system
More IBM personal computers (PCs)
Project management programs
Variety of software programs

B - New Information

- About inputs
- About outputs
- About standards

Examples:

Identify actual workload
Accurate condition reports
Current local labor and material costs
Weekly contracts status reports
Housing master lease
Measures of customer satisfaction
Regular manpower need assessments
Amount of funding available

C - Improvement of Existing Information

- Better access
- Better format

Examples:

Better access to Facility Engineer Job Estimating/Facility Engineer Supply System (FEJE/FESS)
Access to Integrated Facility System (IFS)
Realtime financial information
Updated Standard Operating Procedures (SOPs)
Daily updated housing (HSG) waiting lists
Housing Operation Management System (HOMES) implemented at installation level
Computerized Army regulations
Integrated IFS/Standard Financial System (STANFINS) data.

The frequency distributions of these needs for different functional units are presented in Figure 27. Most functional units need new and better methods rather than new or additional information. Even though all the director's needs are equally present, the most critical ones are related to the availability of standards. Directors who perceive themselves as evaluators of the work performed in their DEHs are much more concerned with the standards by which they can assess the performance. This finding is again consistent with the previous results.

Summary of Results and Implications

The major conclusions of the questionnaire and interview results are summarized below:

1. The Red Book is used more by those who are involved in long-term decisions and tasks (DEH, EPS, and ERMD, Figure 3(b)).

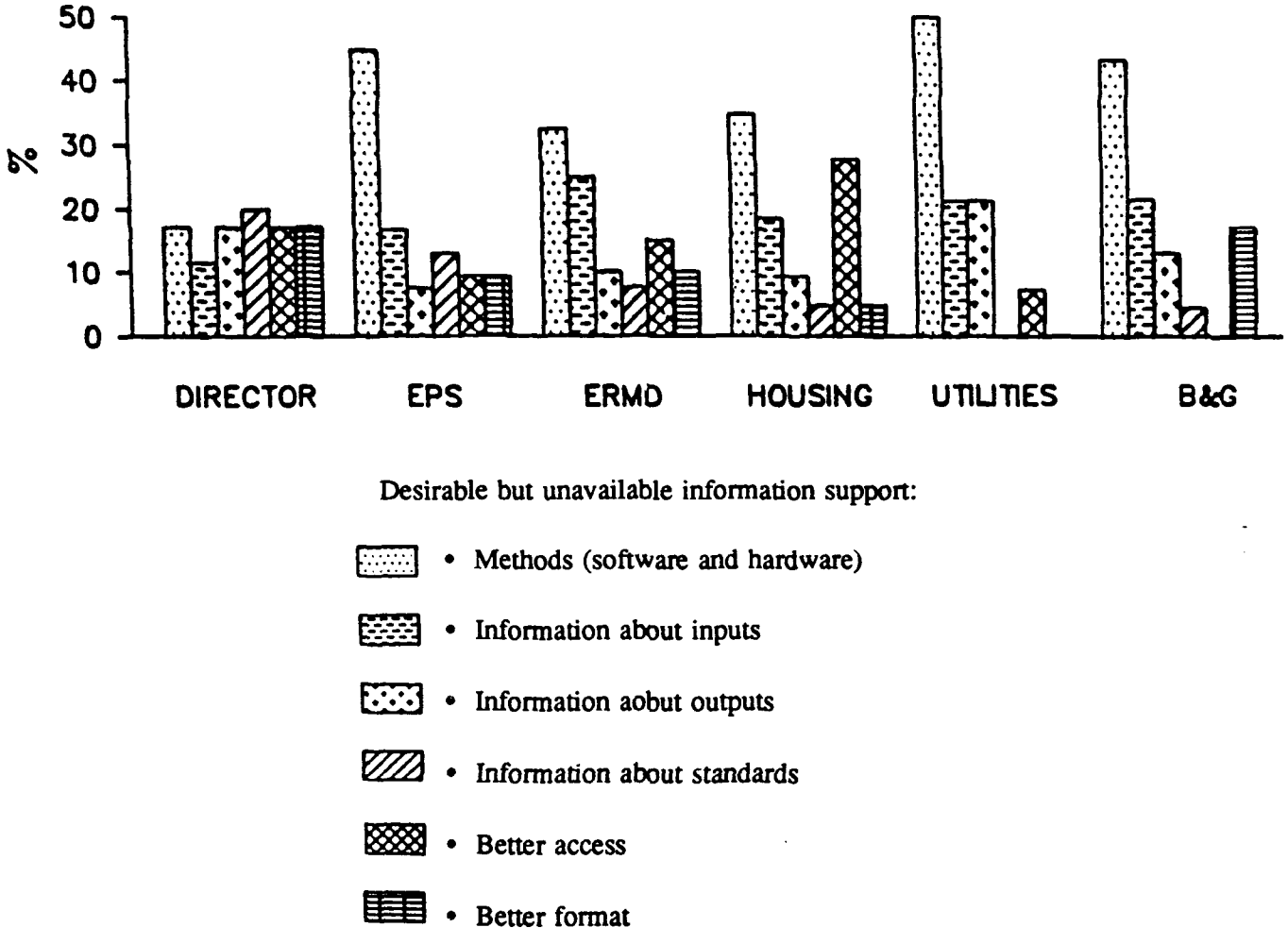


Figure 27. Unavailable information needs.

2. The best potential use of the Red Book is for problem identification (Figure 7).

3. The most preferred way of identifying problems is to compare the actual performance to the plans, especially the Annual Work Plan (Figure 8).

4. Annual data is useful for long-term (e.g., 5-year) plans, not for Annual Work Plans; however, many installations do not or cannot prepare long-term plans (personal communications).

5. It is more difficult to get resources for higher cost projects (Figure 11), because:

a. Methodology, knowledge, and standards for justifying such projects do not exist or are not accessible at the installations, and

b. Efforts are concentrated on short-term tasks (putting-out-the-fires syndrome).

6. The most important constituencies are the line commander and the users of the facilities (Figure 10), therefore the task priorities and the performance standards are determined and evaluated locally (Figures 13 and 14).

7. Existing information sources are inadequate in usefulness, accuracy, timeliness, and format (Figure 22). TRADOC installations rely more on internal information sources (Figure 24) and are more critical of the usefulness of the available information (Figures 20 and 23).

8. However good the available information may be, its utility diminishes if one lacks the methods to use information to accomplish tasks (Figure 27).

9. Operational goals and standards for the installations are not adequately provided by the higher levels (personal communications).

10. Goals are mostly clear (Figure 15), but difficult to achieve (Figure 16); nevertheless, selection of goals does not have much impact on failures (Figure 19).

11. The utilities division alone blames the selected goals for performance failures (Figure 21). Their need for methods is higher (Figure 27) than the other functional units.

Managerial Implications

The above considerations are cross-examined within the framework given in Chapter 2. That is, management control tasks and decisions at the installations and the nature of their complexity, as perceived by the installations, are analyzed below.

When combined, conclusions 8 and 9 imply that planning, programming, and budgeting decisions require an inspirational strategy. Hence, these decisions are often made arbitrarily, often under the influence of the short-term pressures as conclusions 5b and 6 suggest. Long-term considerations are often ignored (conclusions 4 and 5).

A typical case of short-term and arbitrary management practices is the use of Operations and Maintenance, Army (OMA) funds for renewing facilities. Facility renewal is a high-cost project. The standards on physical and functional conditions of the facilities and the long-term cost implications of keeping versus renewing a facility are not known. Because of this lack of knowledge, most installations believe that justification of a renewal project is a hopeless task. Instead, a facility is renewed by using OMA funds in a piecemeal fashion.

Conclusions 9 and 10 present contradictions: goals are lacking, but they are clear anyway, and they are not to be blamed for performance failures. These contradictions become even more conspicuous when conclusion 11 is considered; the only division with a well defined and specific goal blames that goal for performance failures. Some conjectures for the explanation of these contradictions are:

- Goals appear to be clear, because only the local factors are considered (conclusion 6), potentially at the expense of the global issues.

- Installations are often apprehensive about interference from higher levels in the form of being told what to do without being provided any information on how to do it.

The interviews strongly support these conjectures.

Implications on Information Requirements

The three most significant conclusions regarding the task environment of the DEH and the functional units are:

1. The commander of the installation and the users of the facilities are the two most significant constituencies,

2. Operational goals and standards for the installations are not provided adequately by OCE,

3. For successful management, the most acute need at the installations is for tools, staff, and expertise for task performing and decision making.

When combined, these three major conclusions imply that the DEHs and the functional units are almost exclusively preoccupied with short-term (daily, weekly, or monthly) activities. Hence, they mainly need short-term information.

The second and third conclusions, when combined, imply that planning, programming, and budgeting decisions are mostly inspirational. Hence, these decisions are often made arbitrarily. It is unlikely that providing long-term information will make any discernible difference.

Therefore, under the current conditions, extensive and fruitful use of annual data, as reported in the Red Book, cannot be expected without improving the current management practices as well as the contents and the format of the Red Book.

4 THE GOALS AND DECISIONMAKING PROCESSES

The most significant conclusion drawn from the interview and questionnaire results is that Army installations' real property management activities are not necessarily driven by a set of well defined global goals. Instead, the primary driving forces are the local commander and the customers. To appreciate the impact of this situation on information requirements, the role of goals for decisionmaking processes within the scope of management control activities should be understood.

Objectives and Goals

To clearly define the terminology used in this report, fundamental ingredients of a purposive management control system are listed and described in Table 5. The relationships between these ingredients are shown in Figure 28. Strategies, plans, programs, budgets, and policies are based on objectives and goals. (Missions of the Army are strategic decisions outside the scope of this study.)

Table 5

Fundamental Ingredients of a Purposive Management Control System
(Adapted from: G.B. Davis and M.H. Olson, *Management Information Systems*, 2nd Edition (McGraw-Hill, 1985).

Term	Definition and Example
Mission	Broad statement of the purpose of the organization. "Ensure the security and independence of the nation."
Objectives	General statement of what is to be accomplished. "Improve the readiness of the forces."
Strategies	General approaches to achieving goals. "Enhance the flexibility and quality of the facilities at the installations."
Goals	Statement of measurable results to be achieved. "Reduce the average age of the housing facilities."
Plans, Programs, and Budgets	Schedule of specific activities and actions to achieve objectives. "Replace 2 percent of the housing facilities per year, over 15 years."
Policy	Specific rules and standards to carry out planned, programmed, and budgeted activities. "Replace a facility if its maintenance and repair cost exeeds 20 percent of the replacement cost."

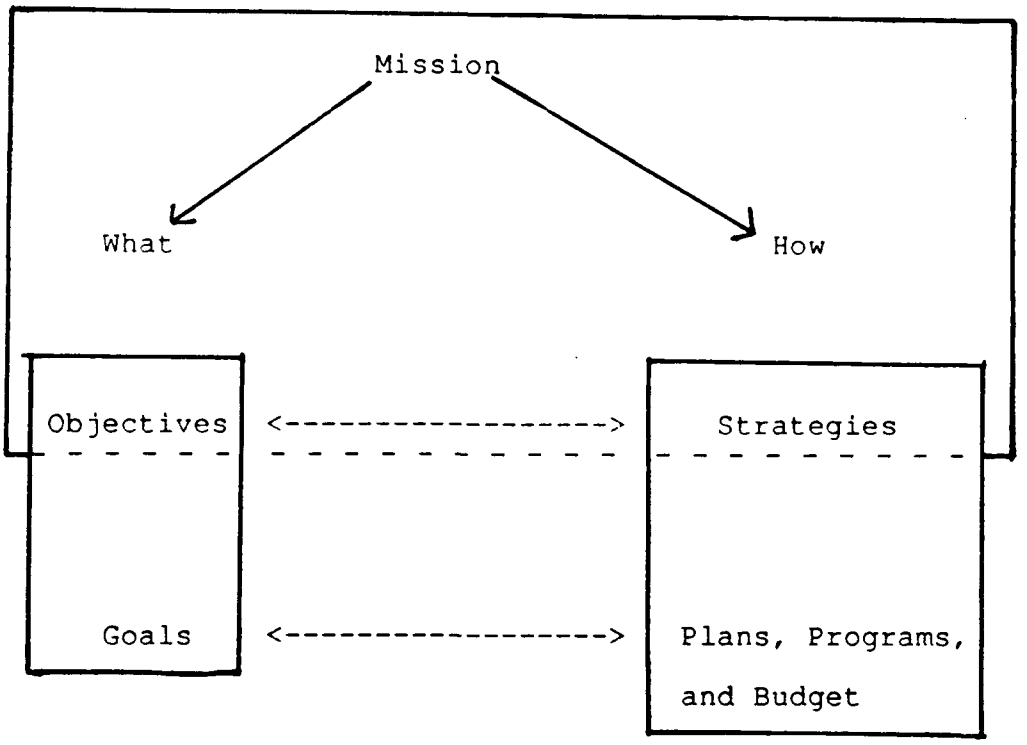


Figure 28. Relationship of terms used in a purposive management control system. (Adapted from: G.B. Davis and and M.H. Olson, *Management Information Systems* (Second Edition), McGraw-Hill, New York, 1985.

An objective is a statement of intended programmatic output, expressed in the broadest terms. It may or may not be related to a specific time period. The main purpose of an objective is to communicate a global set of aims and priorities under which organizational elements should operate. Objectives normally are not quantified, and hence cannot be used directly as a basis of measurement. Instead they provide general guidance on the strategy the organization is expected to follow.

A goal is a specific result, stated in measurable terms, that an organization aims to achieve within a specified time. Goals are essential for a sound decisionmaking process for two major reasons:

- At the beginning of the process, goals enable the manager to identify a good decision from a set of alternative courses-of-actions, and

- After the decision is enacted, goals serve as yardsticks for measuring, comparing, and evaluating the outcomes.

That is, goals are essential both for the rational choice and for diagnostic analysis of the performance of the organization.

Ideally, goals should grow out of the objectives. Since goals would be meaningless without objectives, and vice versa, and since there is no consensus on the semantic difference between these two terms, in this report, goal will be used to mean both goals and objectives.

Rational-Analytical Decision Process

From the normative viewpoint, defining the goals should be specified as the first step in a decision process. These goals are then used as a basis for defining decisionmaking needs, information requirements, and analytical techniques essential to support the process. As the actions are taken or decisions are made, the outcomes are compared with the goals. This comparison serves a number of purposes: evaluating the performance of the process, feedback for learning, and diagnosis of any undesirable (problematic) situation. Figure 29 shows a simple diagram of this process.

Rational-analytical processes are often referred to as Management by Objectives. They are ideal in the sense that the decisionmakers would be moving toward a known target in a well-defined sequence of steps. However, such a process works only if the decisions and problems are well-structured and able to be computed.

Difficulties in Goal-Driven Decisionmaking

Many organizations, including the Army, give little attention to articulating their goals. Simple reasons, such as lack of time or staff, or ambiguous mutual blaming between different hierarchical levels are often offered to explain the lack of formally mandated operational goals. Actually, there are rather fundamental psychological as well as computational reasons for the lack of goals.

1. Identifying and operationally defining goals is a very difficult cognitive activity. It requires intense mental work. People usually avoid work that involves cognitive strain.

2. Goal identification requires looking into the future and causes people to become more cognizant of the uncertainties that already exist. The human tendency is to avoid uncertainty, hence activities such as setting goals and planning for them are avoided if possible.

3. When well-defined operational goals are articulated, individuals are restricted to a narrower range of actions. This reduction in the freedom of action can be perceived as undesirable.

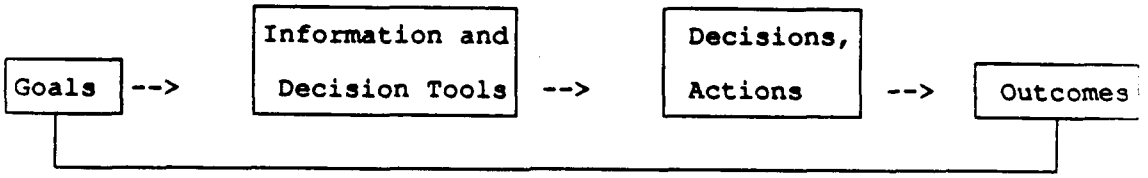


Figure 29. Rational-analytical decision process.

4. A majority of the manager's time is spent on tasks that require immediate attention (the putting-out-the-fires syndrome). Unless all other activities are shut out in order to concentrate on goal setting, individuals cannot get away from pressing tasks.

5. Goal setting requires good judgment and tedious and complex computations. Analysis of past data and current expectations demand complicated computations and complex inferential reasoning. Expertise and satisfactory software tools are not readily available.

6. Goals, even if determined, are often ignored for a number of reasons such as daily pressures. However, lack of operational ties between goals and daily routine work, lack of consensus, and sometimes lack of discipline are the common reasons. People often ignore goal setting because of the belief that the goals will be ignored.

Substitutes for Goals

It is easier, but less desirable, to express goals as constraints. After a thorough analysis of the decision processes in the government, particularly in the Armed Forces, G. T. Allison observes that:[9]

> The operational goals of an organization are seldom revealed by formal mandates. Rather, each organization's operational goals emerge as a set of constraints defining acceptable performance. Central among these constraints is organizational health, defined usually in terms of bodies assigned and dollars appropriated. The set of constraints emerges from a mix of the expectations and demands of other organizations in the government, statutory authority, demands from citizens and special interest groups, and bargaining within the organization.

For example, the behavior of each of the U.S. military services (Army, Navy, and Air Force) seems to be characterized by effective imperatives to avoid: (1) a decrease in dollars budgeted (2) a decrease in personnel (3) a decrease in the number of key specialists (e.g., for the Air Force, pilots) (4) reduction in the percentage of the military budget allocated to that service (5) encroachment of other services on that service's roles and missions, and (6) inferiority to an enemy weapon of any class.

The first four of the above operational goals stated as constraints reflect a prevalent attitude: "let's have the resources first, then we'll decide what to do with them." Ideally, goals and outputs should be determined first, then the resources to accomplish them should be sought, as the Army's recent effort in developing OORMS intends to do.

A more formal and credible substitute for goal setting is standard setting. Operational standards can be set systematically[10] from general goal statements.

Standard Driven Decisionmaking

In goal driven rational-analytical decision processes, the relative attractiveness of each alternative is assessed according to the selected goals, using formal decision tools. The result is usually a rank order of all alternatives, with one being preferable. In contrast, when standards rather than goals are used, each

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[9] G.T. Allison, *Essences of Decision: Explaining the Cuban Missile Crisis* (Little, Brown, 1971).

[10] B. Fischoff, "Setting Standards: A Systematic Approach of Managing Public Health and Safety Risks," *Management Science*, Vol 30, No. 7 (July 1984), pp 823-843.

alternative is categorized as acceptable or unacceptable. The decision process depicted in Figure 29 can still be used if standards replace goals.

To understand the difference between these two approaches, consider the facilities replacement problem. On one hand, a life-cycle cost analysis for each facility would determine the optimal replacement age of the facility. On the other hand, one may set a standard like: "if the total maintenance and repair costs of a given facility exceed a certain limit, the facility should be replaced." In the first case, particularities of each facility are considered and a cost-effectiveness analysis is performed in a custom tailored fashion. Furthermore, in addition to identifying those facilities that should be replaced, a rank order is also provided. Using a standard will yield only a list of facilities to be replaced.

Advantages and Disadvantages

Goal setting is a difficult exercise. When a case-by-case decision approach is used, the rationale behind a choice has to be explained. Such a rationale usually involves a complex tradeoff between diverse considerations pertaining to goals and values. By contrast, many standards offer a concise rule in the form: "If ..., then this is what we want; if ..., then that is what we want." Such a statement encompasses more complex deliberations without leaving a trail explaining the rationale. This is particularly useful when the goals are not clear and the value issues are blurred. For example, the quality of life at an installation primarily depends on the quality of housing. If a decision tool is used to determine the "optimal" condition of housing, one faces the ambiguous and notorious task of evaluating the value of the quality of life in order to justify the costs of increasing that quality. A standard setting approach, however, can avoid value and goal tradeoff issues by considering the current living standards in the society at large as the frame of reference.

Therefore, it is possible to rely on standards even when the goals are not precisely stated. Also, standards do away with the repeated discussion of value issues that comes with case-by-case decision making. Most major decisions are political, requiring a statement of values regarding the appropriate tradeoffs between conflicting goals. When many such decisions are to be made, the decision makers are overwhelmed. One way to avoid this is to replace a set of decisions with one major decision by choosing a general standard. Once set, a standard is a fixed rule that can be applied repeatedly. Unlike formal tools used in case-by-case decision making, standards are not tailored to the particulars of an individual problem.

To summarize, reliance on standards has two major advantages: it can be used even when goals are not precisely articulated, and it replaces a number of "small" decisions with one major decision.

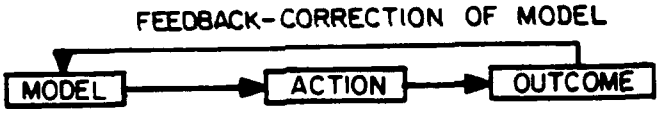
These two advantages, however, can also be viewed as drawbacks. First, once a standard is set, the actual goals behind the standard are lost. This leads to the common problem of confusing the means and the end. A standard is supposed to replace the goals that cannot be articulated precisely, but a standard itself is not a goal. An organization should periodically evaluate its goals and attempt to clarify and quantify them. Hence, in the absence of well articulated goals, standards are the next best thing. However, they should not be a permanent substitute for goals.

Second, a standard is not tailored to the particulars of individual problem situations. Hence, it may always be possible to come up with exceptional cases where the general rule asserted by the standard seems to be ill suited. At worst, these cases shake the credibility of the standard, leading to a general tendency to ignore it. At best, a precedent-setting relaxation of standards can be obtained.

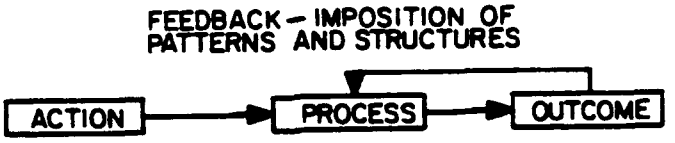
In conclusion, setting standards is a temporary cure for the ambiguity of setting goals and the difficulties in making value tradeoffs.

Alternatives to Rational-Analytical Approaches

Rational-analytical approaches to decision making (Figure 29) work only if the decision problems are well structured--if the goals or standards can be operationally and explicitly stated and if the cause-effect relationships are known (Figure 3). The basic assumption then is that problems are objective realities. Knowledge of the problem can be obtained merely by observation and analysis, and this knowledge should be obtained before any action. If the decision problems are not objective realities, the knowledge about the problem is not "out there" to observe and analyze. Instead, this knowledge can only become available after interaction with the problem and its environment; such interaction is a continuous process. Hence, action comes first, then something happens, and the manager tries to make sense of it. From this perspective, managers are forever trying to make sense of what they have done.[11] These two approaches are contrasted in Figure 30. When the decision problem is not presented to the manager as an objective reality, he/she tries to create one by retrospectively observing the outcomes of the actions. These observations build on experience and judgment and are imposed on the ongoing stream of action in the form of patterns and structures.[12]



(a) A DECISION PROBLEM IS AN OBJECTIVE REALITY AND CAN BE STRUCTURED AS A MODEL



(b) A DECISION PROBLEM IS EMBEDDED IN A SUBJECTIVE PROCESS WHICH CAN ONLY BE UNDERSTOOD RETROSPECTIVELY

Figure 30. Analytical and sense-making approaches to decisionmaking. (Adapted from: R. J. Boland, Jr., "Sense-Making of Accounting Data as a Technique of Organizational Diagnosis," *Management Science*, Vol 30, No. 7 (July 1982), pp 868-882.

[11] K. Weick, *The Social Psychology of Organizing*, 2d ed. (Addison-Wesley, 1979), pp 119-145.

[12] R.J. Boland, Jr., "Sense-Making of Accounting Data as a Technique of Organizational Diagnosis," *Management Science*, Vol 30, No. 7 (July 1984), pp 868-882.

Decisionmaking Practices in RPMA

The Army's real property managers often face problems that are not well structured. Consequently, their decision process resembles the sense-making behavior described above (Figure 30(b)). A typical example is the preparation of the maintenance and repair budget at the installations. Neither the ideal condition of buildings nor how much to spend on them to keep them at a certain condition are known. Hence, first, there is an arbitrarily prepared past year's budget (an action), then one observes the consequences of executing that budget (outcomes) and tries to make sense out of the action and resulting outcome. This sense-making helps them develop certain patterns and structures that can be imposed on the budgeting process. These patterns may be as simple as being content with the current outcomes and increasing the next year's budget by only the anticipated inflation rate. Alternatively, a more sophisticated pattern would include comparing the outcomes with the expectations, identifying those projects that are not accomplished, and preparing the next year's budget based on these projects. The interviews revealed that both of these patterns, and a mixture of the two, are common.

Shortcomings of the Current Practices

The sense-making approach has three major shortcomings.

1. Problems may only appear ill-structured. A decision problem may appear to be ill-structured simply because an individual may lack the tools, techniques, and expertise necessary to objectively structure the problem. For example, when provided with irrigation water and fertilizer, an uninformed farmer may act first (i.e., sow), observe the outcome (i.e., crop yield) and try to make sense out of all this to determine the relationship between the crop yield, irrigation water, and fertilizer. Over time, he would develop a good insight. Would a scientific model relating yield to irrigation water and fertilizer render the problem well-structured? No; a model cannot accurately predict all the consequences because of the environmental uncertainties, such as rainfall, temperature, etc. Then, should the model be dismissed? Even though the question is rhetorical, many managers and engineers dismiss potentially useful computer models claiming that they cannot be useful because of the uncertainties in the problem environment. Instead, sense-making and gut feeling are preferred. The interviews revealed a similar attitude. One engineer said, "All these computer models are useless, Iacocca doesn't use them, he uses gut feelings."

It is important to recognize two different sources of lack of understanding about the cause-effect relationships. One is simply lack of knowledge, such as the specific knowledge of the effects of irrigation on yield. The other is inherent uncertainties, such as the rainfall. Scientific research primarily helps eliminates the first shortcoming; information and statistical data reduce the second. For example, automobile insurance rates for different locations and age ranges are largely based on the statistical data, not exclusively on gut feelings or a sense-making approach.

Therefore, even for ill-structured problems, information and decision tools can be useful even if they cannot completely replace judgment.

2. If there is a decision and action, there must be goals. Even though many decision environments seem arbitrary (e.g., budgeting), there are some implicit goals or standards or, at worst, constraints guiding the action. The process is arbitrary only within certain limits (contraints) that are determined by some driving forces. For example, a request for either $1 trillion or only $1 would be based on an arbitrary decision. However, a manager would probably not make a request that is so extreme.

Three issues surface: identify those forces that act as constraints on decisions, make sure that those forces are a balanced reflection of all parties within the organization, and sufficiently narrow the limits within which the decisions can be made to eliminate arbitrariness yet leave room for local discretion. The questionnaire and interview results shed some light on the first two. Decisions appear to be heavily influenced by the goal of keeping the local commander and the customers happy. These goals are not a balanced reflection of the organization. Furthermore, they are often expressed as constraints that leave room for arbitrariness.

According to regulation, OCE provides goals, policies, and priorities for using RPMA resources. However, in the context of developing an OORMS when asked what outputs OCE expects from the installations, respondents did not give an operational answer. In another instance, an engineer told us that he needs OCE to provide standards, not specific instructions on how to do what.

Developing and using operational goals and standards is a very difficult task. Furthermore, even if this difficulty is overcome, implementing them is another source of difficulty. As mentioned earlier, the only functional unit that complained about the difficulty in achieving the goals is the energy management division, the only one with a specific and well-defined goal.

Therefore, however arbitrary it may seem, individuals work under implicit goals. When implicit, they may counter the global organizational goals. Hence, global goals and standards must be established and explicitly articulated in an operational form. This is an impossible problem when only gut feeling or sense-making approaches are used. There are methodologies to accomplish this task.[13] Furthermore, a statement of goals will also define the information and decision tool requirements.

3. Local feedbacks weigh disproportionately. Suppose it is not possible to structure a problem by developing a better understanding of cause-effect relationships or by developing goals. Then the sense-making approach (Figure 30(b)) is inevitable. Indeed, this is the case for many decisions in RPMA. This approach emphasizes the significance of the feedback obtained from the outcomes. This feedback enables the manager to develop patterns and structures for the process that cannot be modeled as an objective reality. Therefore, the feedback must be informative and free from biases. This may not be the case at many installations. The local managers are heavily pressured by local feedback. Consequently (1) performance of an installation is measured locally with little or no reference to the global performance (2) communication channels with other units at the same or different hierarchical levels are restricted which, in turn, limits the exchange of experience and know-how; and (3) since local feedback tends to be short-term, managers are constantly operating in the putting-out-the-fire mode with little or no attention to long-term tasks. Annual DEH meetings and informal interactions partially make up for the communication needs.

Therefore, long-term and global information is essential for understanding the process, evaluating the performance, and planning effectively.

[13] R.L. Keeney, "Structuring Objectives for Problems of Public Interest," *Operations Research*, Vol 36, No. 3 (May-June 1988), pp 369-405.

Relevance of the Red Book Information

The Red Book is essentially an annual financial report for the real property management activities. The primary function of the annual report is to provide feedback for current and future planning and decisionmaking. As such, the information is an essential feedback input for the decisionmaking process regardless of the approach used (Figures 29 and 30).

If goals or standards are well defined (Figure 29), then the annual data can be analyzed to compare the outcomes with the goals or standards in order to evaluate that year's performance. Furthermore, if the outcomes are less than the goals, the annual report may help identify the source of the problem. For example, suppose an installation could not reduce the energy consumption to a specified level. One possible analysis for that installation is to compare their performance with the reported performance of similar installations. This analysis may identify that, for example, their gas-fired heating plants have much higher unit costs than the comparable installations' plants.

If standards are not formally defined, a representative trend can be used as a standard. For example, average (or median or mode) unit maintenance costs of similar facilities in similar installations can be treated as a standard for those installations. Then, each installation's unit cost can be compared for performance analysis.

If neither goals nor standards are available and a sense-making approach is used (Figure 30(b)), feedback is necessary to understand the process. This feedback should be balanced between local and global information. It should also be balanced between short-term and long-term information. For these purposes, annual reports such as the Red Book contain indispensable global and long-term information.

In summary, the Red Book information is useful for performance analysis and process diagnosis.

Performance Analysis

Performance analysis is an activity essential to assessing how well an organization functions. Performance analysis also sets the stage for diagnostic analysis. Inherent difficulties of performance analysis are further compounded by misconceptions. One such belief is that only the performance of manufacturing industries can be evaluated since these industries produce tangible products. However, a recent study determined that financial information systems were consistently ranked by hospital executives to be the most important information set needed in their jobs.[14] Another commonly held belief is that it is easier to assess the performance of profit oriented companies. However, a brief look at the pages of the *Wall Street Journal* or *Business Week* refute this claim. There are a myriad of management indicators and it is not at all clear which type of company is doing better. Indeed, there are books to help interpret the business indices.[15] Profitability is only one of many management indicators. Furthermore, seven different financial ratios can be identified just to measure profitability.[16] Thus, it is not a straightforward

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[14] S. Strasser and A. Kappen, *The Utilization of Evaluation Research in Hospital Settings: Obstacles and Facilitators to Effective Utilization*, Fund Report to the Esther A. and Joseph Klingstein Fund & Co. (New York, October 1982), p 227.

[15] M. R. Tyran, *Handbook of Business and Financial Ratios* (Prentice-Hall, Inc., 1986).

[16] W. O. Cleverly and H. Rohleder, "Unique Dimensions of Financial Analysis Service Ratios," *Topics in Health Care Financing*, Vol 11, No. 4 (1985), pp 81-88.

task, either for an executive or for an investigator, to evaluate the performance of an organization whether for profit or nonprofit, whether manufacturing or service industry. Nevertheless, such an evaluation is an essential task and an organization's annual financial report is one important input for this task.

A Framework for Performance Analysis

To partially eliminate the prevalent difficulties, controversies, and misconceptions about performance analysis, a comprehensive, yet brief, discussion of the factors and dimensions involved in the analysis will be useful. The discussion is organized by a framework built on (1) components of the system being evaluated, and (2) management concerns regarding these components (Figure 31).[17]

The four system components are: inputs, process, outputs, and outcomes. Inputs refer to resources used to produce outputs. Process is the way resources are arranged to meet the demands for service outputs. Outputs are the products of the organization. Outcomes represent the achievement of organizational goals. There can be distinctions between the delivery of services (outputs) and the actual impact of those services on the achievement of organizational goals (outcomes). For example, the output of the real property management activities at the Army installations is the service (i.e., maintenance and repair)

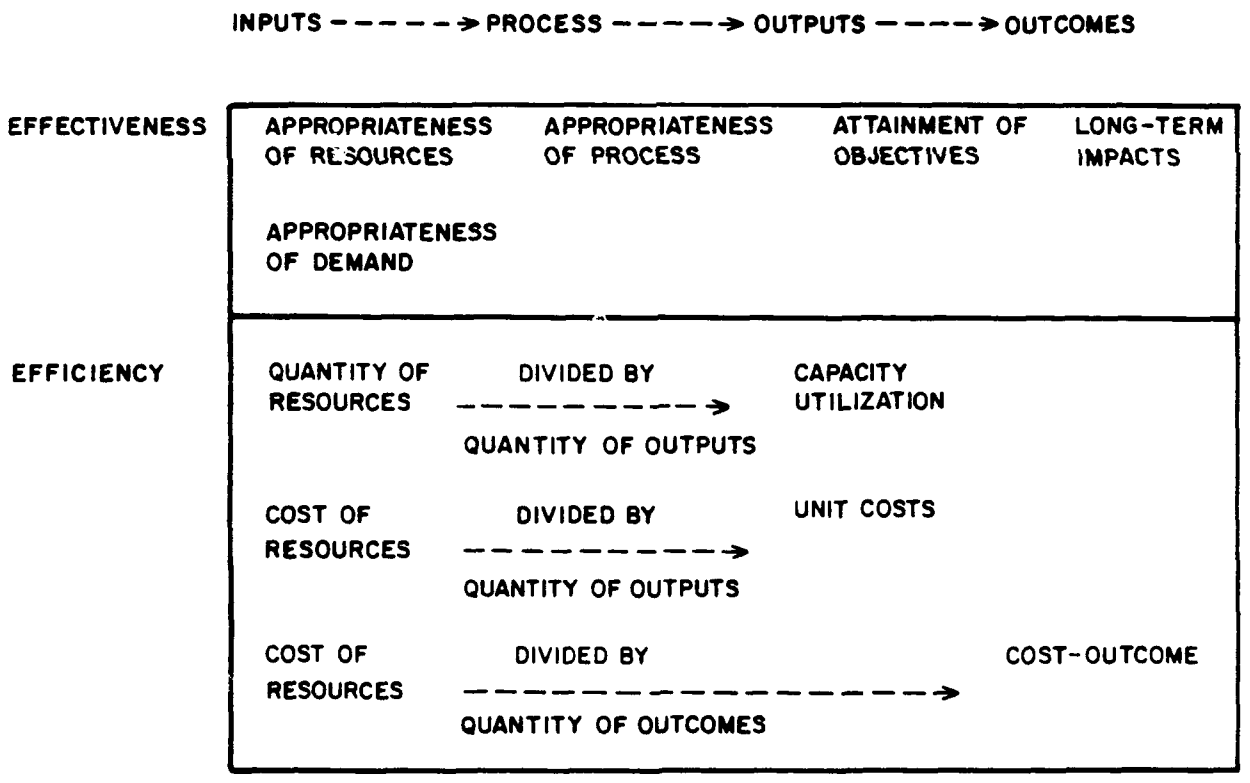

Figure 31. A framework for performance analysis.

[17] R. Elkin and M. Moliter, *Management Indicators in Nonprofit Organizations* (Peat, Marwick, Mitchell and Co., February 19[illegible]

provided to the facilities. However, even if the facilities are well maintained, the overall goals of the Army (e.g., mobility, mission readiness) might have not been achieved. Indeed, in nonprofit organizations there is generally no direct relationship between the delivery of services and organizational goals.

Two management concerns are efficiency and effectiveness.

Efficiency

Efficiency, the ratio of outputs to inputs, is one management concern. Three dimensions of efficiency are: capacity utilization/productivity, unit costs, and cost outcome (Figure 31).

Capacity utilization is an assessment of the efficient use of available resources. Space utilization is a relevant example for Army installations. Staff productivity is an efficiency measure of an organization's personnel. Unit costs are similar to capacity utilization, except the financial resources are the only inputs. A cost-outcome measure is the ratio of either a long- or short-term impact to the resources consumed.

Effectiveness

Generally, effectiveness is viewed as a measure of how well an organization is functioning. Effectiveness focuses on what should be done versus what has been done. There have been many attempts to define and measure the effectiveness of organizations.[18] Table 6 illustrates a number of influential management and organizational philosophies for measuring effectiveness. There is neither an agreement on the meaning of effectiveness, nor in ways to measure it. Indeed, there is no one perspective applicable to all situations. Hence, a number of dimensions should be considered simultaneously.

In this study, the following five effectiveness dimensions are proposed: appropriateness of resources, appropriateness of demand, appropriateness of process, attainment of objectives, and long-term impacts (Figure 31).[19]

Appropriateness of resources measures whether or not the resource inputs are properly chosen. It may reflect acquisition of staff, facilities, equipment, supplies, and money. For example, suppose there is a model that can determine the amount of maintenance and repair that a particular set of facilities should undergo. The actual dollars spent can be compared with the model's prediction to determine if appropriate maintenance and repair resources were acquired.

Appropriateness of demand measures whether the right clients are served. The clients for the real property management activities are people in the installations and physical facilities. Heating an unused facility, for example, is serving an inappropriate demand.

Appropriateness of process measures the quality of service delivery. Timeliness of responses to individual job orders (IJOs) is an example.

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[18] A.Y. Lewin and J.W. Minton, "Determining Organizational Effectiveness: Another Look and an Agenda for Research," *Management Science*, Vol 32, No. 5 (May 1986), pp 514-538.

[19] R. Elkin and M. Molitor.

Table 6

Management and Organizational Philosophies for Measuring Effectiveness

Management Orientation	Philosophy Highlights	Typical Attributes
Scientific management	Time and motion studies; importance of standards; planning control, and cooperation; functional organization; "one best way."	Production maximization, cost minimization, technical excellence; optimal utilization of resources; task specialization.
Principles of management	First "complete" inductive management theory; based on rules or "principles"; views management as a teachable skill.	Division of work; clear authority and discipline; unity of command and direction; order, equity, stability, and initiative; esprit de corps.
Human relations	Importance of emotional factors; sociological concept of group endeavor; satisfied workers are productive workers; need for managerial diagnostic and interpersonal skills.	Productivity through employee satisfaction; satisfaction through attention to workers' physical and emotional needs.
Decisionmaking and information management	Effectiveness subject to bounded rationality; input/output efficiency criterion; functionalization based on subsidiary objectives.	Resource savings through rational development of goals; efficiency of information processing.
Socio-technical	Joint resolution of social and technical organizational demands; social systems view of organizations; enterprise as open systems.	Degree of social/technological "fit" congruence of internal processes.
Strategic management and design	Structure follows strategy; vertical and horizontal integration, and rationalization of resource utilization.	Structure/strategy congruence, manifested as organizational growth, competitive attainment, environmental control and flexibility/adaptation.
Human resources	Importance of organizational needs vs organizational demands; power equalization; participative management; concurrent satisfaction of competing demands; "productive workers are satisfied workers."	Employee satisfaction, productivity; cohesion, loyalty, open communication.

Table 6 (Cont'd)

Management and Organizational Philosophies for Measuring Effectiveness

Management Orientation	Philsophy Highlights	Typical Attributes
Contingency Theory	Organization design based on environmental factors; "best way" contingent on a variety of conditions and situations.	Differentiation error, integration error, organization/environment "fit," ability to implement change in a timely manner, leadership/contingency "fit."
Population Ecology	Relative unimportance of management; environmental determinism; survival a function of life cycle, luck, strategy, and structure.	Survival.
Practitioner Contributions		
	Organizations as cooperative systems	Internal equilibrium and adjustments to external conditions; executive action and example (managerial leadership).
	Decentralized administration, centralized review and control; multidivisional structure.	Efficiency through economy of scale; divisional return on investment (ROI); attainment of objectives (original MBO).
	Debureaucratization, support for local entrepreneurship.	Profitability; staff accessibility; simple structure, rules; lack of meaningless (nonproductive) "peaks."
	Performance on structure, strategy, systems, skills, style, and shared values (7-S Framework).	Bias for action, closeness to the customer; autonomy and entrepreneurship; hands-on, value-driven philosophy; "stick to the knitting"; simple form, lean staff; simultaneous loose-tight properties.

Attainment of objectives measures the degree of accomplishing some service or managerial objectives. The energy conservation goal is an example. Clearly, attainment of objectives depends on the appropriateness of resources, demand, and process. Hence, the dimensions mentioned above can be relevant to the objectives.

Long-term impacts measure if the outcomes coincide with the organizational goals. For example, an installation may find it more economical to contract the soldier's living facilities to private contractors. Because this decision decreases the short-term unit costs, it appears to be efficient. However, creating such a local private economy restricts the flexibility and mobility of the installation; closing the base is likely to become a political issue as local business would oppose such a decision. Another example is the tradeoff between maintenance/repair and renewal. Maintaining and repairing a facility may be less costly in the short run, but renewal could be more economical in the long run. Long-term impacts are perhaps the most difficult effectiveness measure. It usually takes a special study to determine such measures.

RPMA Performance and Red Book Information

The Red Book, in its current form, can at best be used for efficiency measures. These measures can be simply the unit cost of each activity or a combination of different unit costs. A methodology for combining unit costs of different activities to determine a single overall efficiency figure covering all activities has been developed.[20]

To determine effectiveness, RPMA managers must determine objective standards against which performance can be measured.

The interviewees raised strong objections to efficiency measures. Some of the objections stem from misconceptions about performance analysis; other objections are more valid. For example, a poorly maintained facility may appear efficient just because the expenditures are low. Another example is that extenuating circumstances may cause high expenditures, resulting in an undeserved inefficient performance rating.

However, objections do not render an efficiency measure useless or misleading. They only indicate that efficiency alone may not be an adequate description of the performance, hence an efficiency measure must be used with care as a potential indicator of a problem area. Efficiency measures should not be used blindly as a report card although they do shed some light on the performance of RPMA. This information either will be used with care or it will be dismissed at the cost of remaining in the dark and operating haphazardly. Unfortunately, current practice dismisses this information. It is recommended that efficiency measures be used, not only for the sake of good management practice, but also as a reminder that every organization has the obligation to give an account of how efficiently they use financial resources.

Therefore, the Red Book contains indispensible annual financial statements that indicate the efficiency of financial resource utilization.

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[20] G. Perez, O. Coskunoglu, and A. Moore, *Data Envelopment Analysis as a Tool to Evaluate Efficiency of Army Real Property Management Activities, RPMA Spending*, Technical Report P-89/09/ADA205052 (U.S. Army Construction Engineering Research Laboratory [USACERL], December 1988).

Process Diagnosis

The main purpose of a performance analysis is not to write a report card for an evaluated organizational unit, but to set the stage for diagnosing the process within that unit. Diagnosis may be defined as: "the identification of the state of the underlying system on the basis of a set of observable symptoms."[21] As such, diagnosis serves to (1) help understand the behavior of the system (or process), such as trends and cause-effect relationships, and (2) identify problems. Understanding the behavior of the system is also referred to as model building.[22]

Model Building

A model building exercise attempts to answer the question: Given inputs into a process and outputs from it, what must be the behavior of the process (Figure 32)?

A particularly relevant example is: inputs are the J, K, L, and M account expenditures, outputs are the services provided to customers and facilities using these expenditures. The model of the process that converts the inputs to outputs is an indicator of the performance of the system.

Model building can be empirical and based solely on a statistical analysis such as regression analysis, or it can be mechanistic and developed from fundamental physical laws. In most cases a combination of empirical and mechanistic approaches is necessary. Clearly, an empirical approach is based on statistical data.

Problem Identification

A "problem" can be described as the difference between some existing situation and some desired situation. For example, the facilities renewal problem exists if there is a difference between the current condition of facilities and some desired physical and functional condition.

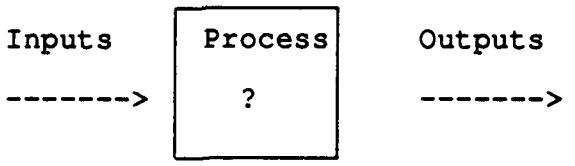

Figure 32. Given inputs and outputs, model building determines the process.

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[21] M. J. Bouwman, "Human Diagnostic Reasoning by Computer: An Illustration from Financial Analysis," *Management Science*, Vol 29, No. 6 (June 1983), pp 653-672.

[22] P. Eykhoff, *System Identification* (John Wiley & Sons, 1974); G. E. P. Box, W. G. Hunter, and J. S. Hunter, *Statistics for Experimenters* (John Wiley & Sons, 1978).

Problem identification is the process of defining differences between the existing and desired situations. These differences can be reduced by operators (actions). Hence, problem solving is the process of selecting those operators. For example, a policy for determining when to renew a facility is an operator; determining that operator is solving the facilities renewal problem.

A manager identifies differences by comparing the existing situation to the perceived output of a model that determines the desired situation. For example, the desirable condition of a facility can be determined using a model that translates the Army's plans into a desirable physical and a desirable functional condition statement.

There are four models that produce expectations against which reality is measured:[23]

1. Historical models in which the near future expectations are based on an extrapolation of past experience,

2. Planning models that contain the projected expectations for the coming years,

3. Models of other people in the organization, such as superiors, customers, other departments (installations), and

4. Extraorganizational models in which expectations are derived from professional standards, from other organizations performing similar functions, or from scientific models.

Each model is essential in identifying the problems and potential improvement areas. They determine aspiration levels that define a satisfactory or acceptable level. Any information on the current situation may work as an aspiration level trigger if it is below some predetermined satisfactory or acceptable level. Such a stimulus allows the manager to sense a problem, if one exists (Figure 33). Problem sensing, however, is not something to take for granted even when the stimuli exist.[24] It is a process that requires an intensive cognitive effort. Stimuli can be misinterpreted, historical criteria can be misleading, expectations can be unreasonable, and managers can either fail to notice, misinterpret, or defensively avoid the information about the existence of a problem. These potential detection errors are shown in Figure 34.

RPMA Process Diagnosis and Red Book Information

The Red Book provides a wealth of statistical data that can be used both for empirical model building and for problem identification.

For empirical model building, the possibilities include:

1. Developing a relationship between services provided for people and facilities, and funds used for those services,

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[23] W. F. Pounds, "The Process of Problem Finding," *Sloan Management Review*, Vol 1, No. 2 (Fall 1969), pp 1-19.

[24] S. Kiesler and L. Sproull, "Managerial Response to Changing Environments: Perspectives on Problem Sensing from Social Cognition," *Administrative Science Quarterly*, Vol 27 (1982), pp 548-570.

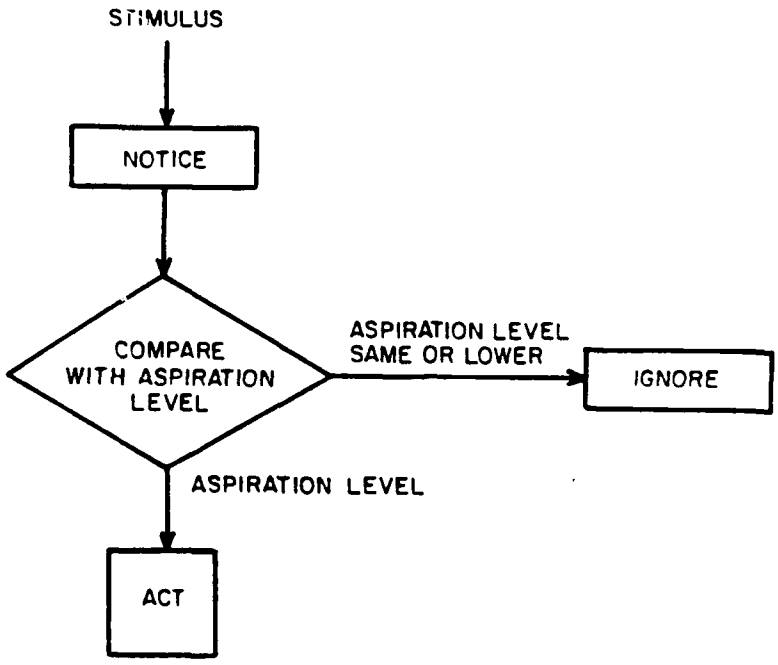

Figure 33. Problem sensing.

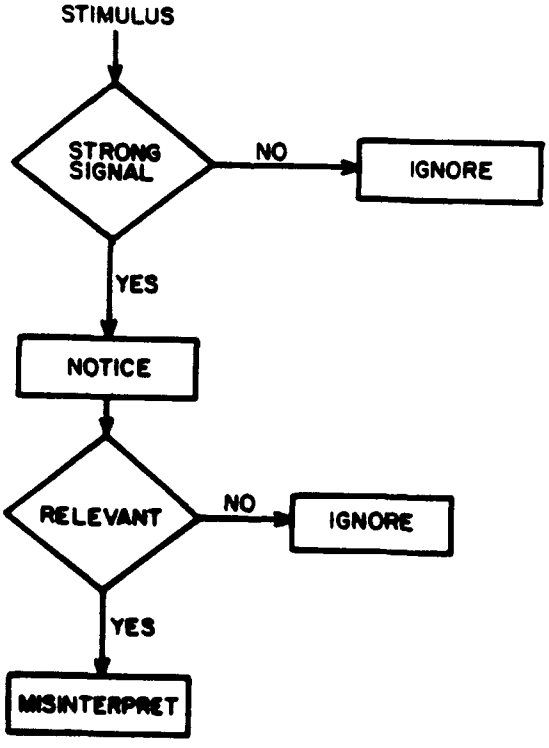

Figure 34. Detection errors in problem sensing.

2. Defining efficiencies for different input/output combinations, and

3. Identifying dynamic behavior (trends, etc.) over time.

For problem identification, in the absence of any better measure, aspiration levels (normal operating conditions) for an installation can be determined from (1) historical data of that installation, and (2) current data of similar installations.

Use of Red Book data in empirical model building and in problem identification may introduce the much needed long-term and global considerations into the decisionmaking process. This may partially balance the disproportionate weight of local and short-term considerations.

In its current format only, however, the Red Book cannot help the manager complete the three steps of the diagnosis process: noticing, interpreting, and incorporating the stimuli. In noticing stimuli, managers must be able to scan the information in the financial report and distinguish the potentially problematic stimuli. Presenting the information in a form where managers will not be lost in a myriad of indicators is necessary for detection to occur. The stimuli then will be interpreted. That is, managers must construct a meaning for, or assign a meaning to, the stimuli. It is not sufficient to leave this interpretation to the experience of the manager. Guidelines and standards for the interpretation of stimuli are essential. In incorporating stimuli, managers must be able to retain the interpreted stimuli as a part of the learning experience.

Errors in detecting and interpreting the stimuli result from either the presentation (display) of the stimuli or from the perceiver's abilities. An effective information system can significantly reduce the effects of the presentation. Guidelines and standards help to reduce the effects of the perceiver's abilities as a source of error.

5 ANALYSIS OF RED BOOK DATA

A number of analyses can be done using the Red Book information.

Cluster Analysis

Cluster analysis is a generic name for a variety of mathematical methods that can be used to find out which objects are similar.[25] The objects within a cluster are deemed to be more homogeneous than objects between clusters.

The first step in cluster analysis is to specify the characteristics (attributes) that define the clusters. This choice depends on the purpose of the analysis, hence different characteristics may yield different results. For example, a philatelist may choose one or more of the following characteristics to classify stamps: nationality, price on it, current value, picture on it, size, etc.

Even identifying the purpose of the analysis does not necessarily determine a unique set of characteristics. Furthermore, different mathematical methods may yield different clusters. These issues have been extensively discussed in the context of clustering business firms.[26] With these issues in mind, a cluster analysis was done to study the performance of RPMA at different installations. The major results are presented below.

For performance analysis, the following management indicators were identified as relevant:

$$MI_1 = \frac{\text{BMAR in previous year} - \text{BMAR in current year}}{\text{K in current year} - \text{K in previous year}}$$

$$MI_2 = \frac{(\text{K} + \text{BMAR in current year} - \text{BMAR in previous year})}{\text{Area}}$$

[25] H.C. Romesburg, *Cluster Analysis for Researchers* (Lifetime Learning Publications, 1984).

[26] R.E. Jensen, "A Cluster Analysis Study of Financial Performance of Selected Business Firms," *The Accounting Review* (January 1971), pp 35-36.

$$MI_3 = \frac{\text{Population}}{\text{Area}}$$

$$MI_4 = \frac{J}{\text{Area}}$$

$$MI_5 = \frac{J}{\text{Area x Population}}$$

$$MI_6 = \frac{K}{\text{Area x Population}}$$

$$MI_7 = \frac{L}{\text{Area x Population}}$$

$$MI_8 = \frac{M}{\text{Area x Population}}$$

MI_1 indicates the rate of decrease in the backlog of maintenance and repair (BMAR) per unit increase in K account dollars. MI_2 is the total amount of money requested per unit area. MI_3 is population density. MI_4 is the J account spent per unit area. MI_5, MI_6, MI_7, and MI_8 are, respectively, J, K, L, and M account dollars spent per unit area per person. Installations are clustered using statistical analysis for each of the years 1984, 1985, and 1986. The results are tabulated in Table 7.

Another cluster analysis is done for the same installations and same years using two site characteristics: population and area. Results are in Table 8.

Table 7

FORSCOM Cluster Analysis Based on Management Indicators

Cluster Number	1984	1985	1986
1	Ord Polk Campbell Riley Bragg Stewart Drum McCoy Lewis McPherson Devens Hood Presidio Richardson -- --	Ord Polk Campbell Riley Bragg Stewart Drum -- Lewis -- Devens Hood -- -- Houston --	Ord Polk Campbell Riley Bragg Stewart Drum McCoy Lewis -- Devens Hood -- Richardson Houston Carson
2	Houston Meade Panama	-- -- Panama	-- -- Panama
3	Carson	Carson	Sheridan
4	Sheridan -- -- -- -- --	Sheridan McCoy McPherson Presidio Richardson Irwin	-- -- McPherson Presidio -- Irwin
5	Irwin --	-- Meade	-- Meade

Table 8

FORSCOM Cluster Available Based on Installation Size and Population

Cluster Number	1984	1985	1986
1	Drum Irwin McCoy Sheridan -- --	-- Irwin McCoy Sheridan McPherson --	-- Irwin McCoy Sheridan McPherson Panama
2	Devens Houston McPherson Presidio -- --	Devens -- -- Presidio Drum Richardson	-- -- -- Presidio Drum Richardson
3	Campbell Meade Ord Panama Polk Riley Stewart -- -- --	Campbell -- Ord Panama Polk -- Stewart Houston -- --	-- Meade -- -- Polk -- Stewart Houston Carson Devens
4	Bragg -- -- -- --	Bragg Hood Lewis -- --	-- -- -- Campbell Ord
5	Hood Lewis -- --	-- -- Meade Riley	Hood Lewis -- --
6	Carson --	Carson --	-- Riley

A quick analysis of those installations changing clusters over time in Table 7 reveals:

1. McCoy's expenditures significantly increased in 1985, relative to 1984, 1986, and other installations with no apparent reason,

2. While McPherson's population and size steadily decrease over time, its expenditures increase sharply,

3. The Presidio's population slightly decreases but its M account shows a sharp increase in 1985.

4. At Richardson, population and size remain constant, M expenditures decrease, but other expenditures steadily increase.

5. Even though Sam Houston changes clusters, expenditures don't change sharply, and population and size remain fairly constant.

6. Carson's population significantly decreases in 1986 but expenditures do not.

7. Sheridan has a sharp increase in L account in 1985 with all other values being rather stable.

8. Riley is increasing in population but its relative position per unit expenditures remains constant.

A Cost Model

One problem for the Army's real property managers is to predict the maintenance and repair costs as a function of some observable variables. A number of solutions have been tried. For example, linear regression analysis has been used to relate maintenance and repair costs to the area (in thousand square feet) of facilities. These efforts have not yielded satisfactory results because of two assumptions. First, is the linearity assumption. Second is the assumption that one model would fit all installations. We relieved these assumptions by building nonlinear models and by developing a model for only those installations that belong to the same cluster. A sample result is discussed below.

First, a cluster analysis was performed using size, population, and unit costs of J, K, L, and M accounts between 1983 and 1985 as characteristics. All installations except Panama and Forts Greely, Carson, Bragg, and McPherson formed a cluster. K account expenditure of those installations in the cluster were averaged over 1983, 1984, and 1985. Likewise, average population and size values for each installation during these years were computed. Then the average K account expenditures per person per thousand square feet was plotted against a measure of magnitude defined as

$$\text{magnitude} = (\text{population}) \times (\text{Area in K sq ft})$$

The plot is given in Figure 35, from which the economy of scale is emerging. When the magnitude of an installation is larger than 450 billion person-ft, the unit cost of the K account is about 3 cents per person per thousand square foot (average over 1983, 1984, and 1985). When the magnitude is below 450

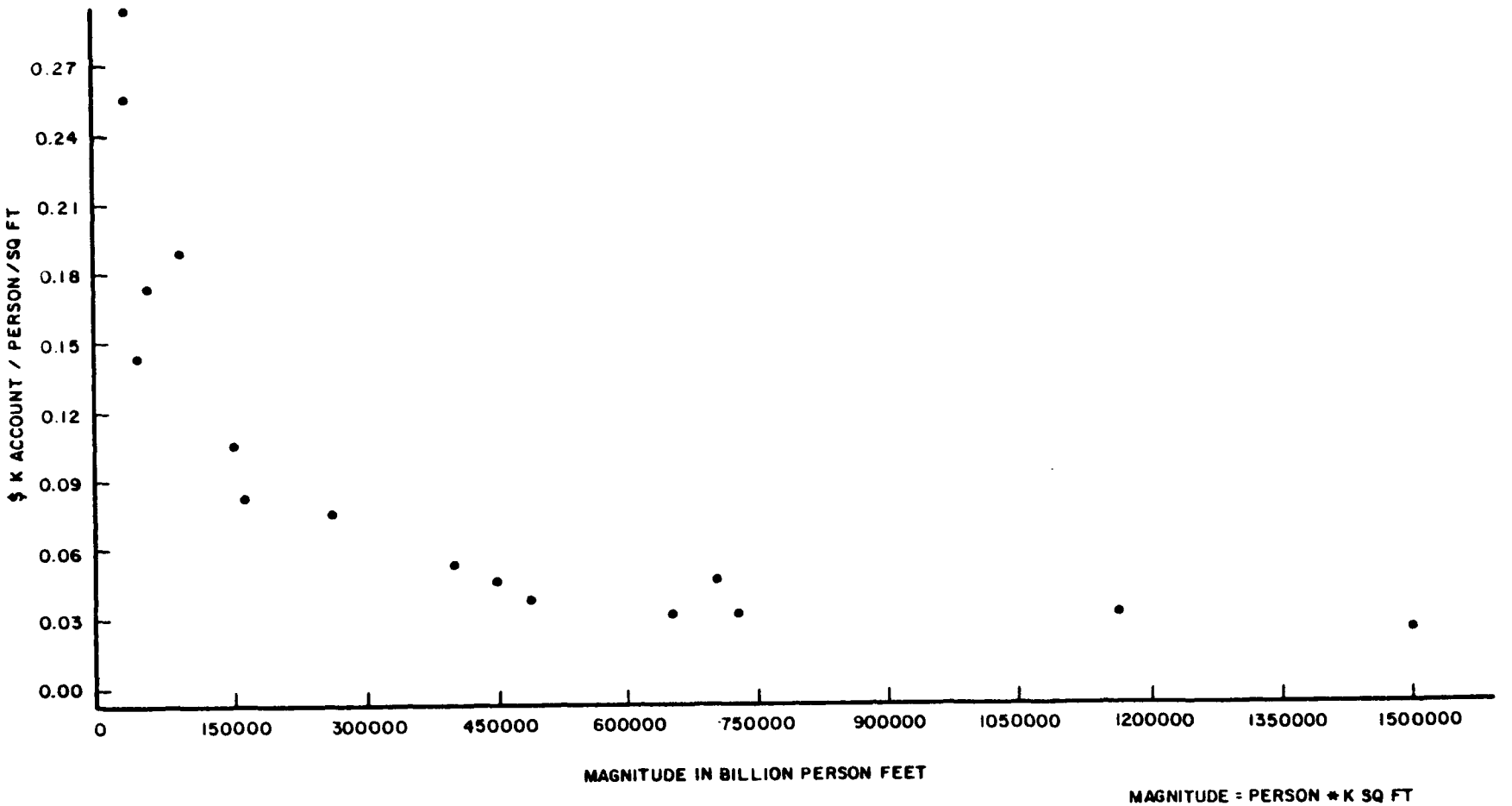

Figure 35. Average K account expenditures (over 1983, 1984, 1985) per unit of magnitude versus magnitude.

billion person-ft, this unit cost increases exponentially. To show that exponential relationship, the logarithm of K account dollars is plotted against the logarithm of magnitude in Figure 36. The correlation coefficient between these two variables is 0.93368. This is a remarkably high correlation. The highest reported correlation, 0.90, was by the Center for Naval Analyses[27] for the Navy's base operating costs. In their model, total base operating costs, not only maintenance and repair, are related to five variables: active military personnel, number of civilian personnel, building area, land area, and energy consumption. Our model was limited to maintenance and repair costs and two explanatory variables: total personnel and total area.

[27] D.B. Levine and J.M. Jondrow, *The Determinants of Base Operating Support Costs*, Report No. CNS 1156/May 1981 (Center for Naval Analyses, 2000 North Beauregard St., Alexandria, VA 22311).

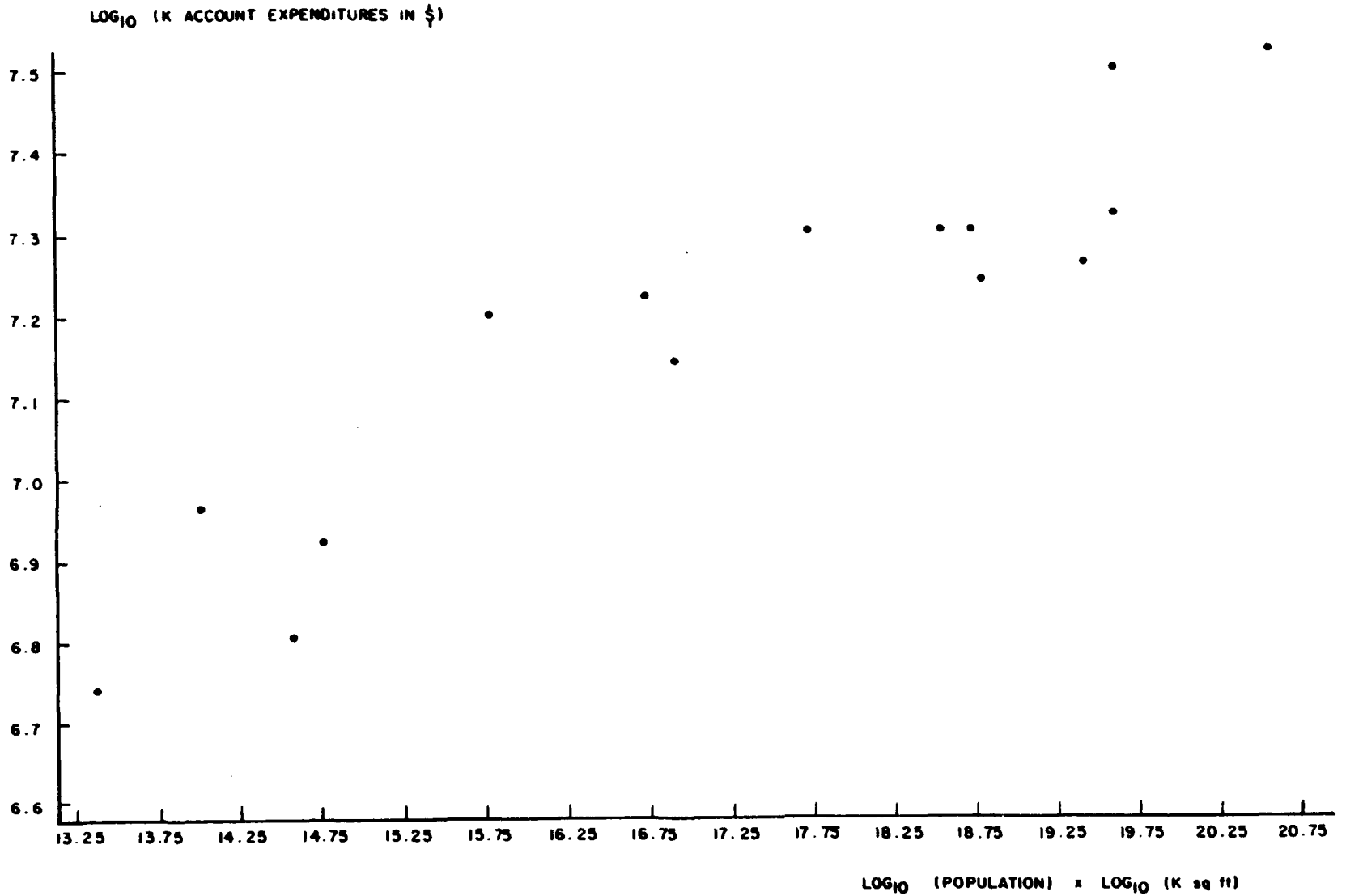

Figure 36. Linear relationship between logarithm of K account expenditures and the logarithm of magnitude, with 0.93368 correlation coefficient.

6 CONCLUSIONS AND RECOMMENDATIONS

Both theoretical and empirical analyses of the decisionmaking process of real property managers were performed in this study to identify information requirements. The most significant finding is that real property managers make decisions within constraints that primarily determined by the local commander and customers. In the absence of global goals and feedback, their work tends to focus on local and short-term concerns. Therefore, a global and long-term information source like the Red Book is essential to change this unbalanced focus in decisionmaking. However, as long as the current management practices remain intact, Red Book information does not appear to have much to contribute. Furthermore, the managers lack the time and tools necessary to analyze the raw data provided in the Red Book.

Therefore, the recommendation is to keep publishing and distributing the Red Book while providing the necessary incentives and tools to use it.

If the incentive and tools for using the Red Book information at the installations and MACOMs can be provided, the benefits that are likely to materialize include:

- The focus of the managers can be better balanced between local, short-term concerns, and global, long-term ones.

- Decisions can become more purposive, goal-driven, and global performance oriented.

- Improved feedback hence better understanding of their processes and problems can materalize.

It is recommended that organizations conduct a rigorous analysis of the type of decision problems encountered by the real property managers in order to understand and reveal the decisionmaking structure or lack of it.

It is also recommended that MACOMs and installations work with OCE to develop goals, standards, and aspiration levels, particularly standard unit costs and goals for functional and physical conditions of facilities.

To make the Red Book information readily usable, it should contain trends and significant changes that have occurred historically or across installations. It should contain relevant analysis rather than just providing trhe compilation of numbers. To accomplish this without unduly increasing the size of the volume, the following recommendations are offered.

1. In addition to its current content, Volume II should also contain:

   a. A value measure (e.g., replacement value) for each group of facilities,

   b. Change in the value from last year and from the last 3 years' average.

2. Volume I, in addition to its current summary, should also contain:

   a. A number of cluster analyses in order to identify those installations similar to each other from different perspectives (size, function, location, etc.),

b. A list of those installations that change clusters and possible explanations for the change,

c. Unit cost analysis for major clusters of installations (as demonstrated in Chapter 5), relating unit costs to explanatory variables and showing the change of the relationship over time,

d. Goals, standards, and performance measures for each real property management activity and how installations form clusters against these factors.

3. An additional booklet should be published containing an analysis of each installation's expenditures over time and in relation to other similar installations. If any anomality is observed, it should be indicated for further analysis by the installation. Thes booklet should be sent to only the installation and to its MACOM. An automated process could be used to compile the data for the booklet. Furthermore, the booklet can be designed so that the information is effectively displayed graphically using appropriate visual display techniques.[28]

Finally, tools are needed to support the installations' ability to analyze information and to use it in their decision process. Two main needs are: tools for statistical analysis and tools for decision aiding especially to deal with decisions which require value tradeoffs, and problem structuring. Further specifics of these tools can be identified only after a rigorous analysis of the decision problems faced by the real property managers.

[28] E.R. Trufte, *The Visual Display of Quantitative Information* (Graphics Press, 1983).

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APPENDIX

Sample Questionnaire

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

REPLY TO
ATTENTION OF:

DAEN-ZCF

SUBJECT: Information Needs Assessment, Directorate Engineering & Housing - Survey Questionnaire [RCS: MIL PC-3 (OT)]

SEE DISTRIBUTION:

This questionnaire is part of an organization assessment survey which is being conducted throughout the DEH offices of US Army installations. The purpose of the survey is to learn more about the information and communication needs of your organization and its functional units. The results of the survey will be used to identify and help solve information problems and to determine if and where improvements can be made to increase decision-making effectiveness, productivity, and employee morale.

This questionnaire focuses on the functional unit that you supervise. It measures various characteristics of your functional unit, and the existing information sources that you use for decision making. You are also given opportunities to indicate your views about existing information needs and suggest ways to improve the current situation. Your answers are strictly confidential. The answers you give will be grouped with the answers of other people, and no individual person will ever be identified in any report. After the questionnaires have been analyzed, you will receive feedback on the survey in the forms of statistical summaries. Hopefully, you will find these feedback information valuable for evaluating your unit's information needs and for identifying where improvements might be appropriate.

If this survey is to be useful, it is important that you answer each question frankly and honestly. There are no hidden meanings behind any questions. This is not a test and there are no right or wrong answers. Once you complete the questionnaire please mail it in the self-addressed envelope provided within three weeks after you have received it.

DAEN-ZCF
SUBJECT: Information Needs Assessment, Directorate Engineering & Housing - Survey Questionnaire [RCS: MIL PC-3 (OT)]

This survey was developed and is being conducted by the Departments of General Engineering and Business Administration at the University of Illinois. The university has been contracted by our organization to conduct this survey as an independent agent.

FOR THE CHIEF OF ENGINEERS:

Richard L. Nelson
for: EDWARD T. WATLING
Chief, Facilities Engineering Division
Office, Assistant Chief of Engineers

Encl
DISTRIBUTION:
Special

INFORMATION NEEDS ASSESSMENT
THE DIRECTORATE OF ENGINEERING AND HOUSING OPERATIONS

TO BE COMPLETED BY
ENGINEERING RESOURCES MANAGEMENT DIVISION

GENERAL INSTRUCTIONS

In this questionnaire your functional unit includes you and all individuals who report directly to you within your functional division.

Most of the questions ask you to circle one of several numbers that appear on a scale below the item. Corresponding with each number on a scale is a brief description of what the number represents. You are to circle the one number that most accurately reflects your answer to each question.

INTRODUCTORY QUESTIONS

The following questions are very important for properly coding and analyzing the data. As indicated before, all responses will be kept strictly confidential. When you are finished with the questionnaire, seal it in the accompanying envelope and mail it to the address printed on the envelope.

1- Name of the **installation** in which you work:_____
_____

2- Name of **functional division** in which you work:_____

For coding only:

All cards: column

__	__	__	__	__	__	__	__	__	__
1	2	3	4	5	6	7	8	9	10

A- General information about the installation and the DEH office

1- Sources and allocation of resources

a- Because of the nature of different installations, your sources of funds may differ. Please indicate below the different sources of funds as a percentage of your annual budget:

sources of funds	% of your total budget
1- RDTE	_____
2- AIF	_____
3- OMA	_____
4- OPA	_____
5- AFH	_____
6- Reimbursables	_____

b- If you consider the average allocation of your funds for the last three years what percentage of your total budget is usually allocated to the following items:

	% of your budget
1- outside contracts	_____
2- new projects	_____
3- recurrent activities	_____
4- unexpected emergencies	_____
5- mission changes	_____

2- The following questions are asked to collect some factual information about the installation you operate in:

a- how many contractors performed jobs for you in the last year? _____

b- What is the total number of personnel who work for your functional division?_____

c- What is the total number of on post military personnel you serve in the installation?_____

d- What is the total number of job and service orders you processed with in the last year?_____

3- Every installation, when compared to the others within the same MACOM, is unique with respect to some of its characteristics. PLease itemize in the space below some of the most unique characteristics of your installation which should be taken into consideration (with respect to your own functional area) when evaluating the information neeeds of your unit?

_____
_____
_____
_____

B- Nature of the task environment

With these questions we want to find out how much uncertainty there is in decision making. Such information is necessary in order to determine the degree of information needs of your functional division.

1- How important are the following parties for accomplishing the mission of your functional division?

	NOT AT ALL	VERY LITTLE	SOME	QUITE A BIT	VERY MUCH
Higher levels in the hierarchy (e.g. MACOM):	1	2	3	4	5
Customers of the facilities: (e.g., clients, users, etc.)	1	2	3	4	5
Line command (such as the commander of installation):	1	2	3	4	5
Outside contractors:	1	2	3	4	5
Contracts office: (in your installation)	1	2	3	4	5
Comptrollers office: (in your installation)	1	2	3	4	5
Local government agencies:	1	2	3	4	5
Other Federal Agencies:	1	2	3	4	5
Office of the Chief of Engineers:	1	2	3	4	5
Another division in your DEH: (please specify:_____)	1	2	3	4	5

2- Considering that you interact with the following parties on a regular basis, to what degree are you aware of the expectations and future actions of these parties?

	NOT AT ALL	VERY LITTLE	SOME	QUITE A BIT	VERY MUCH
Higher levels in the hierarchy (e.g. MACOM):	1	2	3	4	5
Customers of the facilities: (e.g., clients, users, etc.)	1	2	3	4	5
Line command (such as the commander of installation):	1	2	3	4	5
Outside contractors:	1	2	3	4	5
Contracts office: (in your installation)	1	2	3	4	5
Comptrollers office: (in your installation)	1	2	3	4	5
Local government agencies:	1	2	3	4	5
Other Federal Agencies:	1	2	3	4	5
Office of the Chief of Engineers:	1	2	3	4	5
The division in your DEH: (the one you specified above)	1	2	3	4	5

3- Sometimes the demands and expectations of the parties you deal with change. To what extent are the demands and expectations of the following parties predictable?

	NOT AT ALL	VERY LITTLE	SOME	QUITE A BIT	VERY MUCH
Higher levels in the hierarchy (e.g. MACOM):	1	2	3	4	5
Customers of the facilities: (e.g., clients, users, etc.)	1	2	3	4	5
Line command (such as the commander of installation):	1	2	3	4	5
Outside contractors:	1	2	3	4	5
Contracts office: (in your installation)	1	2	3	4	5

Comptrollers office: (in your installation)	1	2	3	4	5
Local government agencies:	1	2	3	4	5
Other Federal Agencies:	1	2	3	4	5
Office of the Chief of Engineers:	1	2	3	4	5
The division in your DEH: (the one you specified above)	1	2	3	4	5

4- Please consider the following types of projects you were involved in within the last three years and rate each of them according to the scale below:

Scale

1 For most of these projects we were able to acquire the resources without any difficulty.

2 As long as we prepare the required forms very carefully and justify our needs, money is usually available.

3 Money is usually available but it requires a lot of time and energy to convince the higher management to receive it.

4 Even for the most basic necessities we have to fight to get the needed resources.

Type of Projects	your rating			
a- Major construction: New	1	2	3	4
Replacement	1	2	3	4
b- Minor military construction	1	2	3	4
c- Maintenance	1	2	3	4
d- Repairs	1	2	3	4
e- Improvements (e.g., energy)	1	2	3	4
f- Enhancement of environment (e.g., landscaping)	1	2	3	4
g- Environmental restoration	1	2	3	4

C- Organizational Decision Making

The following questions are designed to elicit your perception of the decision making processes in your functional unit. (Please circle the appropriate number)

1- For most decisions we make in our unit, we are usually sure which actions will produce which outcomes.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

2- For most decisions we clearly know our objectives and preferences.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

3- In our functional unit most decisions can be considered routine or programmed.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

4- For most decisions we need consultations between highly specialized experts.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

5- Most major decisions usually reflect compromises made that are political in nature.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

6- There are tight formal controls of most decisions by means of sophisticated information and control systems.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

7- There is great centralizations in decision making with most operating decisions made at the top such as MACOM.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

8- There is strong emphasis on always getting personnel to follow the formally laid down procedures in decision making.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

9- For most major decisions there is emphasis on the immediate future outcomes rather than long term outcomes.

1	2	3	4	5
very true	true most of the time	true some of the time	not true most of the time	completely false

D- Nature of Task Interdependencies

We now focus on the most important "other units" that your division developed and maintained task related contacts with during the past three years to accomplish your functional goals and responsibilities.

IN ALL QUESTIONS, THE TERM "OTHER UNIT" REFERS TO ANY OTHER GROUPS, OFFICES, LEVELS, OR DIVISIONS WITHIN OR OUTSIDE OF THE ARMY THAT YOUR FUNCTIONAL UNIT COORDINATES WITH.

In the lines below write down the names of the five most critical or important offices based on the above description.

1-_____

2- _____

3-_____

4- _____

5- _____

Once you identified the five other units, answer the following questions for each other unit individually by writing in the appropriate columns the most accurate number from the scale for each question.

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
1- Does this other unit exist within your organization (MACOM)? (circle no or yes)	N Y	N Y	N Y	N Y	N Y
if yes: a- do you supervise this other unit in your organization's hierarchy?	N Y	N Y	N Y	N Y	N Y
b- do you formally report to this other unit in your organization's hierarchy?	N Y	N Y	N Y	N Y	N Y
c- does this other unit occupy the same level within the hierarchy?	N Y	N Y	N Y	N Y	N Y

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
if no:					
a- do you have a contractual relationship with this other unit?	N Y	N Y	N Y	N Y	N Y
b- is it mandatory by government regulations that you coordinate with this other unit?	N Y	N Y	N Y	N Y	N Y
2- During the past year how much was your unit involved with this other unit for each of the following reasons: (please use scale below)					
a- to receive or send work or clients?	____	_____	_____	_____	_____
b- to receive or send resources (e.g., money, personnel, equipment, or supplies)	____	_____	_____	_____	_____
c- to receive or send technical assistance (e.g., consultation or staff services in functional areas)	____	_____	_____	_____	_____
d- to receive or send information for purposes of coordination, control, planning, or evaluation?	____	_____	_____	_____	_____

NOT AT ALL	A LITTLE	SOME-WHAT	QUITE A BIT	VERY MUCH
1	2	3	4	5

3- For this other unit to accomplish its goals and responsibilities, how much does it need the services, resources, or support from your unit?	____	_____	_____	_____	_____

NOT AT ALL	A LITTLE	SOME-WHAT	QUITE A BIT	VERY MUCH
1	2	3	4	5

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
4- For your unit to accomplish its goals and responsibilities, how much do you need the services, resources, or support from this other unit?	____	_____	_____	_____	_____
5- How much say or influence does your unit have on the internal operations of this other unit?	____	_____	_____	_____	_____
6- How much say or influence does this other unit have on the internal operations of your unit?	____	_____	_____	_____	_____
7- Consider now the quality of the give and take relationship with each unit. Compared to other units that you are involved with, how fair do you feel are the payoffs to your unit from this unit?	____	_____	_____	_____	_____

NOT AT ALL	A LITTLE	SOME-WHAT	QUITE A BIT	VERY MUCH
1	2	3	4	5

WE GET MUCH LESS THAN WE SHOULD	WE GET SOMEWHAT LESS THAN WE SHOULD	BALANCED	WE GET SOMEWHAT MORE THAN WE SHOULD	WE GET MUCH MORE THAN WE SHOULD
1	2	3	4	5

E- Nature of Communication

Please use the following scale for the questions in this section and rate each of the units separately.

NOT ONCE	1-2 TIMES A YEAR	ABOUT EVERY 3 MONTHS	ABOUT MONTHLY	ABOUT EVERY 2 WEEKS	ABOUT WEEKLY	ABOUT DAILY
1	2	3	4	5	6	7

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
1- During the last 12 months, how frequently have people in your unit communicated or been in contact with people in this other unit?	____	_____	_____	_____	_____
2- Specifically, how frequently did your unit communicate with the other unit through each of the following ways during the last 12 months:					
a- through written letters, memos, or reports of any kind?	____	_____	_____	_____	_____
b- through personal face-to-face discussions?	____	_____	_____	_____	_____
c- through telephone calls?	____	_____	_____	_____	_____
d- through group committee meetings between three or more people from your and the other units?	____	_____	_____	_____	_____
4- During the past 12 months, how often did exceptions or problems arise in sending or receiving work, resources,or services to and from this other unit?	____	_____	_____	_____	_____
5- During the past 12 months, how often were there disagreements or disputes between people in your unit and this other unit?	____	_____	_____	_____	_____
6- When these disagreements or disputes occured, how often were they handled in each of the following ways during the past 12 months? (Please use the scale on the next page)					

ALMOST NEVER	SELDOM	HALF AND HALF	OFTEN	ALMOST ALWAYS
1	2	3	4	5

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
a- By ignoring or avoiding the issue?	____	_____	_____	_____	_____
b- By smoothing over the issues?	____	_____	_____	_____	_____
c- By bringing the issues out in the open and working them out among the parties involved?	____	_____	_____	_____	_____
d- By having a higher level of authority resolve the issues?	____	_____	_____	_____	_____

F- Major Functional Tasks Performed by Your Division

Listed below are some major tasks which could have an impact on the performance of your unit. We are interested in the extent of your influence in determining what actions are taken with respect to these tasks. Please read the six categories carefully. Then, for each task group check the category which most closely describes the way that the decision is "typically" determined.

OUR INITIATIVE. We as a DEH identify an issue on which action or decision appears necessary, and proceed as follows:

OUR DECISION. I or one of my suborinates decide what action to take. (Note: We are not asking whether you have the authority to decide, but whether or not you usually make the decision without first discussing it with others outside your DEH.)

TWO-PERSON DECISION. My superiors and I discuss the issue and decide which action to take.

MULTI-PERSON DECISION. My superior and I, and other line or administrative managers outside of my Directorate who need to be involved, discuss the issue and decide which action to take.

HIGHER AUTHORITY DECISION. What action to take is decided by my immediate superior because it requires a change in existing policies, or is the responsibility of a higher level in the hiearchy.

INITIATED BY OTHERS. The need for an action of this sort is usually initiated by a higher level administrative department, but we may be consulted before the decision is made.

	our initiative				
	my decision	two person decision	multi person decision	higher authority decision	initiated by others
1- Financial management	1	2	3	4	5
2- Coordination of work planning	1	2	3	4	5
3- Administration of contracts	1	2	3	4	5
4- Identification of M and R requirements	1	2	3	4	5
5- Evaluation of work requests	1	2	3	4	5
6- Determination of work methods	1	2	3	4	5
7- Annual Work Plan	1	2	3	4	5
8- Material requirements	1	2	3	4	5
9- Manpower planning	1	2	3	4	5
10- Unconstrained requirements report	1	2	3	4	5

G- Criteria and Methods Used to Evaluate the Performance of Division

Please consider the three most important criteria or measures that are used to determine how effectively your unit performs its tasks.

List below the three most important criteria that are used to measure how well your unit performs its work.

Rank the importance of these three criteria

1- most important
2- second most important
3- third most important

1-_____Rank:_____

2-_____Rank:_____

3-_____Rank:_____

Please specify below the information sources you use for each of the criteria:

1-_____

2-_____

3-_____

1-How much influence or say did each of the following have in deciding upon these criteria? (please use the scale below)

NONE	LITTLE	SOME	QUITE A BIT	VERY MUCH
1	2	3	4	5

	criterion ONE	criterion TWO	criterion THREE
a- people in line management or staff positions outside of your immediate work unit?			
b- you, as the unit supervisor			
c- your immediate subordinates			
d- you and your immediate superiors as a group			
e- your immediate supervisors alone			
f- MACOM alone			

2- How much do people in your division agree that these are the three most important criteria for evaluating the performance of your unit?

NOT AT ALL	AGREE A LITTLE	AGREE SOMEWHAT	AGREE QUITE A BIT	AGREE VERY MUCH
1	2	3	4	5

Criterion 1:_____ Criterion 2:_____ Criterion 3:_____

3- To what degree are numerical or quantified procedures used to measure these performance criteria?

NO MEASUREMENT IS MADE	ONLY SUBJECTIVE NONQUANTIFIED IMPRESSIONS ARE RECORDED	LOOSE BUT QUANTIFIED MEASURES ARE RECORDED	SPECIFIC QUANTIFIED MEASURES ARE RECORDED	VERY PRECISE QUANTIFIED MEASURES ARE RECORDED
1	2	3	4	5

Criterion 1:_____ Criterion 2:_____ Criterion 3:_____

4- How frequently do you receive numerical reports detailing the performance of your unit in terms of these criteria?

NO REPORTS ARE RECEIVED	ALTHOUGH MEASURED I HAVEN'T RECEIVED ANY REPORT	ONLY AT YEAR END	EVERY MONTH	EVERY WEEK	EVERY DAY
1	2	3	4	5	6

Criterion 1:_____ Criterion 2:_____ Criterion 3:_____

5- A variety of methods can be relied upon to determine and evaluate how well an organizational unit is achieving its performance criteria. To what degree are each of the following methods of appraisal relied upon to evaluate how well your functional division performs its work:

	NONE	LITTLE	SOME	QUITE A BIT	VERY MUCH
a- appraisals made by line managers or staff specialists outside of your work unit.	1	2	3	4	5
b- appraisals made by you individually, as the unit superior.	1	2	3	4	5
c- appraisals made by your subordinates who individually review and evaluate their own performance.	1	2	3	4	5

d- appraisals made by you and your immediate superiors as a group.	1	2	3	4	5
e- appraisals made by your immediate superior alone.	1	2	3	4	5

6- How clearly have specific performance targets been set for your functional division?

NO TARGETS WERE SET	TARGETS ARE VERY UNCLEAR	TARGETS ARE SOME-WHAT CLEAR	TARGETS ARE CLEAR	TARGETS ARE VERY CLEAR
1	2	3	4	5

7- How difficult is it for your unit to attain these performance targets?

NO TARGETS WERE SET	VERY EASY TO ATTAIN	QUITE EASY TO ATTAIN	DIFFICULT BUT ATTAINABLE	VERY DIFFICULT TO ATTAIN	NOT POSSIBLE TO ATTAIN
1	2	3	4	5	6

8- When target performance goals were not attained, which of the following are the most common reasons for failure?

	ALMOST NEVER	SELDOM	SOME-TIMES	QUITE OFTEN	ALMOST ALWAYS
A- Lack of available money	1	2	3	4	5
B- Lack of communication	1	2	3	4	5
C- Lack of well trained personnel	1	2	3	4	5
D- Lack of useful infor mation	1	2	3	4	5
E- Lack of higher lavel support	1	2	3	4	5
F- Selection of improper targets	1	2	3	4	5
G- Lack of available soft-ware (e.g., methods) and hardware (e.g., computer)	1	2	3	4	5

9- In relation to other comparable divisions within your MACOM, how would you rate your unit on each of the following factors for the past year:

	UN-ABLE TO JUDGE	SOME-WHAT BELOW AVERAGE	ABOUT AVERAGE	SOME-WHAT ABOVE AVERAGE	WELL ABOVE AVERAGE
a- the quantity of work produced?	1	2	3	4	5
b- the quality of work produced?	1	2	3	4	5
c- the number of innovations or new ideas introduced?	1	2	3	4	5
d- reputation for work excellence?	1	2	3	4	5
e- attainment of predetermined goals?	1	2	3	4	5
f- efficiency of unit operations?	1	2	3	4	5
g- morale of the personnel?	1	2	3	4	5

H- Rules, Policies, and Procedures

Please think about the various operating rules, policies, and procedures that all personnel in your unit are expected to follow to coordinate and control all the major work activities performed in your functional division.

Please write down the code numbers of the rules, policies, and procedures that you refer to regularly in order to coordinate and control all jobs and activities of your division as a whole.

_____
_____
_____
_____
_____

1- How precisely do these rules, policies and procedures specify how work activities are to be coordinated and controlled in your division?

VERY GENERAL	MOSTLY GENERAL	SOMEWHAT SPECIFIC	QUITE SPECIFIC	VERY SPECIFIC
1	2	3	4	5

2- How often do unit members violate or ignore these rules, policies, and procedures?

NEVER	VERY SELDOM	ABOUT HALF THE TIME	QUITE OFTEN	ALL THE TIME
1	2	3	4	5

3- How strictly are these operating rules, policies, and procedures enforced in your functional division?

NOT AT ALL ENFORCED	VERY LOOSELY ENFORCED	SOMEWHAT STRICTLY ENFORCED	QUITE STRICTLY ENFORCED	VERY STRICTLY ENFORCED
1	2	3	4	5

I- Information Sources for Task Performance

In the following section we would like to know your ideas about the available information sources that you use for the accomplishment of your tasks. Please, list below the four most frequently used and effective information sources (e.g., FEJE, AWP, DD1391, FESS) which you utilize in planning, decision making, and performance evaluation in your DEH.

1-_____

2-_____

3-_____

4-_____

Once you identified the four major sources, answer the following questions for each of them individually by writing in the appropriate column the most accurate number from the five point scale for each question.

	SOURCE I	SOURCE II	SOURCE III	SOURCE IV
1- Frequency of use	_____	_____	_____	_____

almost never 1 2 3 4 5 almost always

	SOURCE I	SOURCE II	SOURCE III	SOURCE IV
2- usefulness	------	------	------	------
very useful 1 2 3 4 5 not useful at all				
3- accuracy	------	------	------	------
very accurate 1 2 3 4 5 never accurate				
4- timeliness	------	------	------	------
very timely 1 2 3 4 5 never timely				
5- accessability not easy to access 1 2 3 4 5 very easy to access	------	------	------	------
6- format of the information	------	------	------	------
very useful 1 2 3 4 5 not useful at all				
7- Who is responsible for the praperation of this source?	------	------	------	------

our unit	a seperate unit	a higher level unit	an independent agency or unit
1	2	3	4

8- Please list below the types of information which you think are very useful and/or necessary for the operations of your division but are presently not available.

I-_____

II-_____

III-_____

J- Questions About the REDBOOK

In this last section of the questionnaire we would like to know your ideas about the REDBOOK which is prepared from the Technical Data Reports. We are mainly interested in finding out how you use this specific source of information in your decision making activities.

1- During the last 12 months, how frequently did you refer to the REDBOOK to get information?

NOT ONCE	1-2 TIMES A YEAR	ABOUT EVERY 3 MONTHS	ABOUT MONTHLY	ABOUT EVERY 2 WEEKS	ABOUT WEEKLY	ABOUT DAILY
1	2	3	4	5	6	7

2- Do you do any analysis on the REDBOOK information for your own use?

NEVER	VERY SELDOM	SOME OF THE TIME	QUITE OFTEN	ALL THE TIME
1	2	3	4	5

If you marked 3, 4, or 5, please describe below what kind of analysis you do:

3- Is the present format in which the information presented in the REDBOOK useful for you?

NOT AT ALL USEFUL	SOME-WHAT USEFUL	USEFUL	SOME-WHAT USEFUL	VERY USEFUL
1	2	3	4	5

If you marked 1, or 2, please describe below how the format can oe changed:

4- Please specify below the type of information presented in the REDBOOK which you find useful to have:

a-_____
b-_____
c-_____
d-_____

5- Which of the following, do you think is more appropriate type of data to have in the REDBOOK? (Please circle one below)

1- actual expenditures 2- obligations 3- does not matter

6- For which of the following reasons you may find the information in the REDBOOK useful?

a- to compare different installations	YES	MAY BE	NO
b- to get rough estimates of certain cost items	YES	MAY BE	NO
c- to identify problem areas	YES	MAY BE	NO

d- others (please specify below)

_____
_____

7- An important function of managers and engineers is to identify the problems within their organizational units. A problem is conceptually defined as the difference between some existing situation (reality) and some desired situation (expectations). Which of the following, do you think, is a reasonable way to identify the problem areas in your functional unit?

A- Comparing your existing situation to some historical trends.

VERY REASONABLE	SOMEWHAT REASONABLE	NOT REASONABLE	DO NOT KNOW
1	2	3	4

B- Comparing your existing situation to specific plans and programs.

VERY REASONABLE	SOMEWHAT REASONABLE	NOT REASONABLE	DO NOT KNOW
1	2	3	4

C- Comparing your existing situation to the expectations of the higher levels in your organization.

VERY REASONABLE	SOMEWHAT REASONABLE	NOT REASONABLE	DO NOT KNOW
1	2	3	4

D- Comparing your existing situation to other units' existing situations in your own MACOM.

VERY REASONABLE	SOMEWHAT REASONABLE	NOT REASONABLE	DO NOT KNOW
1	2	3	4

E- Comparing your existing situation to some other similar organizations.

VERY REASONABLE	SOMEWHAT REASONABLE	NOT REASONABLE	DO NOT KNOW
1	2	3	4

THANK YOU.

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